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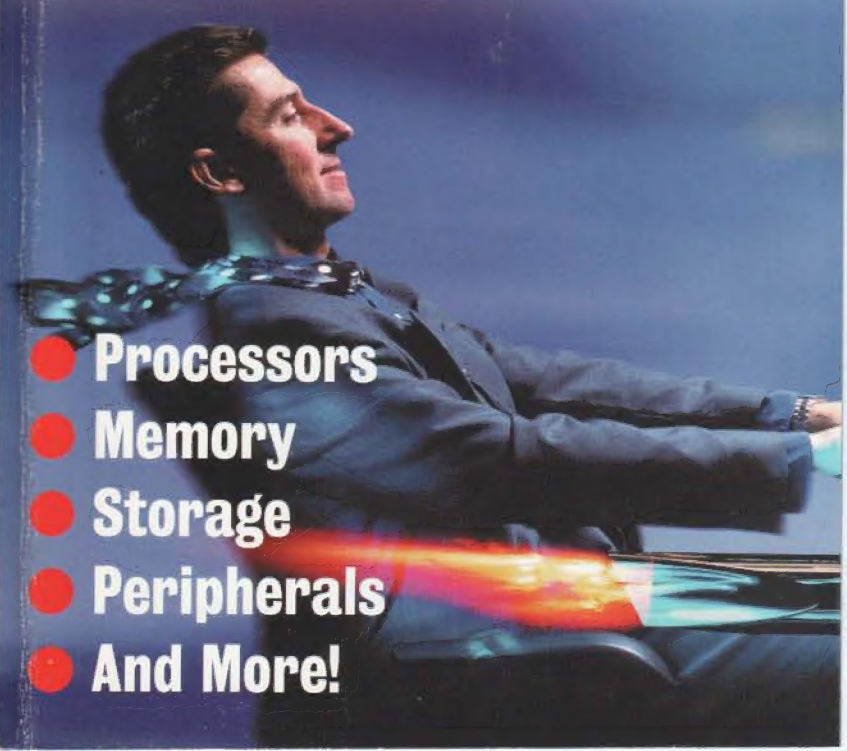

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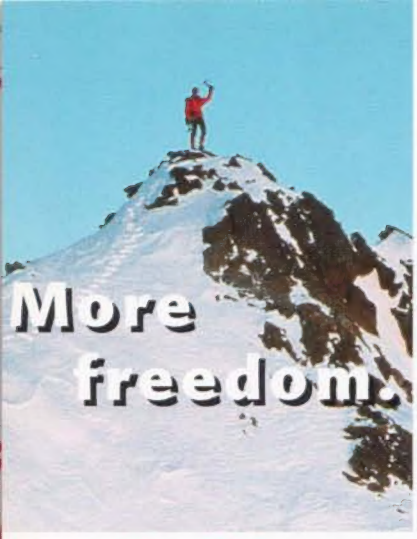

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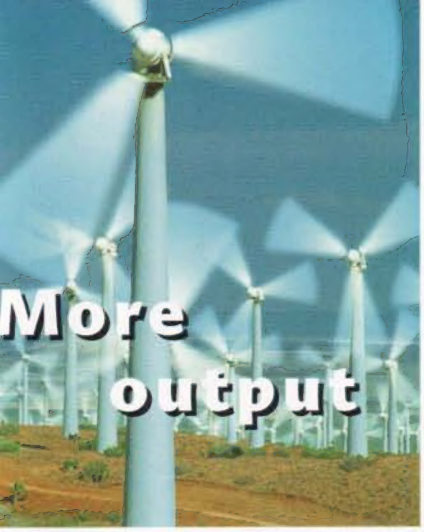

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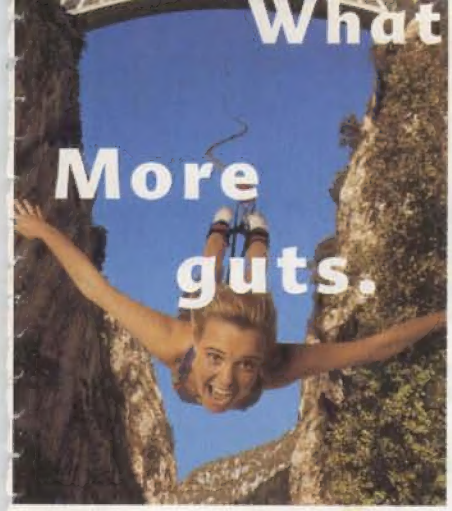

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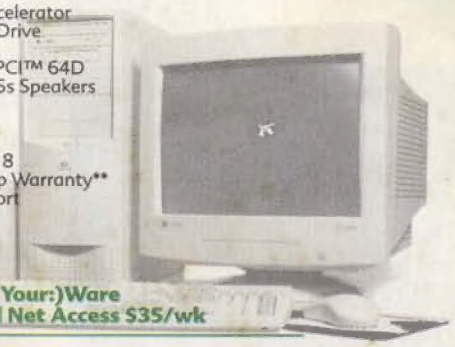

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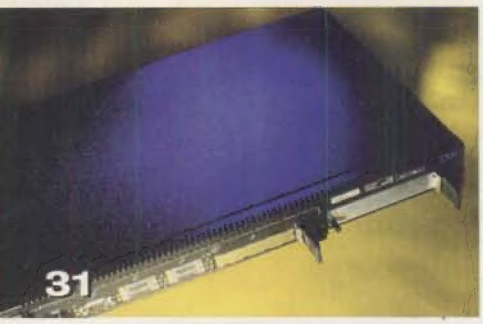

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*PC Magazine Editor's Choice – November, 1998 Monster Fusion. **PC Authority Recommended Award – Viper V550 – November & December 1998.

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Brian Haverty

Numbers Games

The Melissa virus is on the loose! Don't open that e-mail or your computer will blow up! The government is keeping tabs on your Web surfing habits! Headlines like these would have you believe that viruses and PC paranoia are all that is on any computer person's mind these days.

But if the mail I see from readers is anything to go by, those topics don't even rate.

There is something far more horrifying to the PC user today; something that seems to make even the most seasoned professional recoil in terror. I'm speaking, of course, of *TLA*s, or three-letter acronyms.

If I'm interpreting this correctly, I would say that there is a number of people out there who read computer articles like this: lips pursed, hand on chin, nodding sagely . . . until they hit an abbreviation that is not immediately followed by a parenthetical explanation. This causes the reader to slam the book or magazine closed, let out an enraged *arrrrggghh*, and begin writing a letter to the person responsible for the outrage.

I sincerely hope that these people only represent a very vocal minority. (No doubt they are the same ones who were completely unable to use an index in school—the people who would let out an amazed "ooohh" when they were shown how to flip to the back of the book.) Most of us know that if the TLA cannot be figured out from the context of the article, one can still find any number of glossaries on the Web simply by typing "computer acronyms" into a search engine.

No—letters are no problem for the serious computer user. But I'm beginning to think that number might be.

I'm finding the numbers in product specifications less and less able to give me an idea of actual performance. Part of the problem lies in the fact that some numbers represent performance differences that are undetectable by the user under normal circumstances.

With colour inkjet printers, for example, "dots per inch" figures no longer give the full picture (so to speak). More than the number of dots per inch, it's how those dots are placed within that space, and the volume of ink each dot contains that contributes to final print quality.

Page per minute ratings, too, are becoming a bit superfluous. Some printers, for example, handle text pages with multiple fonts better than others. Some are faster with complex graphics. Whatever their faults and benefits, printers (lasers included) rarely meet their ppm ratings across the range of document types.

Then there are the numbers that go with PC performance. CPU speed these days is only part of the equation. New motherboards offering faster bus speeds can greatly affect performance. New instructions like the SIMD extensions handled by Intel's new Pentium III processor have the potential to improve speed, but only with software that is designed to take advantage of those instructions.

So are there any numbers that we *can* rely on? The only ones I think have any validity are independent benchmarks based on real-world testing. Ziff-Davis' benchmarks Winstone and WinBench are two good examples of independent tests developed to evaluate PC system performance. The RMIT PC Test Lab in Melbourne is also working on specific tests for use in testing printer performance.

Armed with the results from tests like these, it will be an easy thing to pick out lopsided specs from vendors and we hope that they'll go far in ensuring that the days of confusion over performance are, well, numbered.

No—letters are no problem for the serious computer user. But I'm beginning to think that numbers might be.

More on the Web:

Read Brian Haverty's monthly column, exclusively at PC Magazine Online.

www.zdnet.com.au/pcm/opinions

LETTERS

changing so fast, it's hard to imagine any record company executive being able forecast beyond the next two years . . . no, make that one year.

SEAN DIGGINS
VIA THE INTERNET

When comparing the quality of uncompressed 16 bit 44.1KHz CD audio to the quality of an MP3 you must take into account that the bulk of MP3s available on the Net are encoded at a 128kbps bit rate. This makes the files relatively fast to encode and quick for users to download. You're right, this is not CD quality, but when you are encoding your MP3 you can up the bit rate to 160, 192, 224, 256 or 320kbps to provide an even better sound (though it will make downloading a little tougher on your modem connection).

—Anna Raciti
Assistant Editor

PLEASE EXPLAIN

I am quite interested at the moment with the with the current debate in Federal Parliament about Pornography on the Internet. I am currently studying Information Technology and my interest is in the Internet. I do not like to visit these sites due to fact that I believe that these sites are usually degrading to women but I am interested in finding out how the government is going to govern ISPs if this law is passed.

Under current federal, state and international laws, your ISP is not allowed to check up what people do on the Internet unless they have a court warrant. If the new law is passed ISPs will have to break existing privacy laws in order to comply.

Can anyone please explain this law to me please!

JAMES MCALLISTER
VIA THE INTERNET

MORE INFO, PLEASE!

In replying to James Lawson [Letters, April 1999], you didn't actually answer his question. James knows about the SENDTO folder—what he doesn't know is what to put there in order to return to his previous capability of doing a send-to using the standard internet mail.

From memory, as my machine is not configured to use the internet mail that James wants, there is a single file in the WINDOWS directory with the name "Internet Mail". If a shortcut for this is placed into SEND TO or onto the desktop for that matter, it will enable access to the original Internet mail.

ROB VON NESSELRODE
VIA THE INTERNET

THEY DENIED KENNY!

I recently came across a problem for the first time, and after making some enquiries find I am not the only one to encounter it. I generally use Netscape Communicator as my Browser, and in the past I have not encountered any problems accessing Internet sites. Recently, however, I tried to access an ftp site, and could not gain access. In sheer desperation, I tried using Internet Explorer, and accessed the site without any difficulty. I have spoken to others about my experience, and it appears mine is not an isolated case.

Do you have any suggestions as to why one browser will access a site whereas another will not? Until this problem occurred, I always thought that apart from opting to use the program that one feels comfortable with, there was very little difference between browsers.

I look forward to any advice you can offer me on this problem.

WARREN J. KENNY
VIA THE INTERNET

No one we've spoken to has encountered the problem you describe. How about our readers?

—Editor

CORRECTION

• In the digital camera review that appeared in our April 1999 edition, the software bundle listed for the Olympus C-900 Zoom and C-1400XL was incorrect. Both cameras come with PhotoAlbum organiser software, PhotoShop plug-in for Mac and TWAIN driver for PC. The C-1400XL also comes with Camedia utility software, while the C-900 includes Camedia Master utility software

Competition Winners

In our March issue competition, we asked readers to come up with some interesting words to go in the cartoon bubble at the right. Two lucky winners will receive a **Canon BJC-7100 colour Bubble Jet printer** (worth $599).

The most common response? It was: "All I did was buy a Canon!" Then there were a lot along the lines of "I'll have to get one of those Canon printers for my *wife*!"

John Manning sent in an entry that was clever, but a bit too much of an in-joke to win the big prize: "If he s-squeezes me any t-tighter I will P-Pop!" (referring to Canon's P-Pop paper coating technology).

So that brings us to the winners—first an entry from Monica Finley of Western Australia, who proved that persistence can pay off (she sent in several entries). Her wording was "I think using a $100 note to show him the print quality of the Canon BJC-7100 was a *big* mistake!"

Our second winner is Len Francis from Queensland: "Working for Canon is great—I get to meet all these satisfied customers!"

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If you're looking for a Slot 1 motherboard upgrade, the SuperMicro P6SBA exudes quality. It's both fast and good value for money, making it the motherboard of choice.

SBA370 (PPGA)**

This motherboard (installed in the Beyond SuperO Velocity system) has just won the Value award in April's PC@uthority.

The SuperMicro Super 370SBA motherboard has an ATX form factor and, besides having a the velocityPPGA socket at the top, is reminiscent of many Slot 1 motherboards for the Pentium II processors. . . the Velocity truly lives up to its name and posts a significantly higher score than the average Labs score for Pentium II/400 systems. . . Considering the outstanding performance and top notch peripherals that fill the system, the Beyond should comfortably satisy even the most demanding users.

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See article in PC @uthority March 1999 page 64, April 1999 page 54.

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MP3 Spells Disaster

The MP3 format and the trading of music on the Internet will destroy the music industry within the next two years. Fact is, the music business is counter-productive and ripe for change. The RIAA's attempt to kill off the Diamond Rio player in the US was the last straw as far as public tolerance is concerned. The

music industry, in a vain attempt to protect itself, killed the DAT format and has recently lobbied various governments to impose strict penalties for bootleggers.

The US Congress has outlawed reverse engineering with the passage of a ludicrous electronic copyright bill. Now the record industry is experimenting on Canadians by trying to impose a $2.50 "royalty" tax on each blank CD-R disk sold.

But MP3 bootlegging is already rampant, and that's the record industry's own fault. It began with the self-imposed destruction of the singles business. Singles dominated the world right until the dawn of the CD and cassette. But singles on CD and cassette are impractical. Nowadays, a person usually has to shell out $30 for an entire CD, which seldom contains more than two decent songs. Most popular bands have been one-hit wonders, and the majority of them were incapable of ever producing an album full of songs. MP3 fills the gap.

To make matters worse for itself, the industry is overcharging for CDs, which should have been selling for less than $20 for at least the last five years. There's no rationale for a CD to cost more than a cassette—a linear medium with moving parts! Few record sellers will even discount CDs, because co-op advertising money would be pulled from these stores. This co-op ad money, paid by the record labels, has been used to prop up high prices. The public is sick of it.

Compound this with the general bad reputation recording companies have developed over the decades. Stories about how they rip off their own artists abound. Everyone has heard about bands that were never paid their royalties or that signed away their lives and got nothing in return. This industry has not endeared itself to the public.

Enter MP3, a compression method that turns a three-minute song into 3MB of CD-quality audio that can be converted to a WAV file and burned on a CD-R. The trading of commercial tunes over the Net in this format is rampant. Take a look at IRC; do a /list *mp3* to witness the mania. (Go to *www.mirc.com* to download an excellent IRC client. For an MP3 player I suggest Winamp at *www.winamp.com*.)

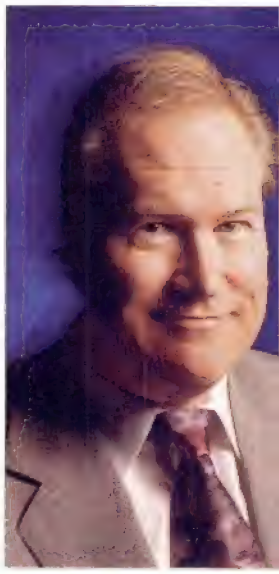
I recently went on a couple of these sites and discovered that every single hit record on the Billboard chart could be illegally downloaded. The MP3 Web sites have been effectively shut down by the record companies, but real-time online lash-ups such as IRC can't be so easily stopped.

The best MP3 distributors are sending files from fake or hacked IP addresses that can't be traced back to the real sender. I'm told IRC is just the tip of the iceberg of potential bootlegging. The top IRC system, EFnet, can handle 40,000 to 50,000 simultaneous online users; ICQ can have 500,000. AOL can have a million! The trading of MP3s is unstoppable. The laws against it will do nothing.

More bad news: most collectors of MP3s are the traditional young buyers between 12 and 24. The majority are minors, not subject to adult laws and unlikely to be prosecuted for distributing or collecting bootleg recordings. Some have CD burners, but most keep songs on their computers in MP3 format and play them natively. The latest Microsoft media player now handles MP3! I'd like to see what develops if the RIAA sues Microsoft over this. Meanwhile, those kids with CD burners make disks for their friends.

More interesting is the sheer number of musicians who have embraced MP3 and use it as a marketing tool. This phenomenon also has music industry execs spooked. They're losing control of the content and the channels of distribution. In short, they're toast.

I sure don't condone illegal activity, but I'm not surprised. This is a trend that a greedy, cavalier industry brought on itself. It expects morality from its customers while producing songs that advocate otherwise. Irony abounds. As far as I'm concerned, the music industry deserves the worst for what it did to DAT. Obliteration seems just.



The trading of MP3s is unstoppable. The laws against it will do nothing.

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Doing It Your Way

Christmas morning, around the tree. My 7-year-old got the Lego MindStorms robot kit. It was supposed to be for ages 11 and up, but what the heck; he's a smart kid. Exactly 11 minutes later, he was in his room building something with it. The result, trotted out an hour later, didn't look much like anything in the

MindStorms manual—but his creation worked, and it was great.

I saw a lot of his dad in him that morning. Because for years, I've enjoyed taking products meant to be used for one thing and turning them around, to ends that are often just the opposite of—or simply unrelated to—what their creators intended.

Two good examples: the new Dragon NaturallySpeaking Mobile package, which adds to the company's best-of-breed speech recognition software a pocket-size, solid-state recorder (the NaturallyMobile), and Deja News, a Web site that tracks Usenet newsgroups.

Dragon's advertising for the NaturallySpeaking Mobile package makes clear the company's intention: this kit will let users break the bonds that tie them to their PCs when using Dragon NaturallySpeaking. You stick the recorder in your pocket, dictate wherever you go, dump your dictation into the PC, and process it into Microsoft Word 97 files back at your desk.

Fair enough. The NaturallyMobile works fine that way. And the product is a logical line extension for Dragon, which beefed up its offerings in the fourth quarter of 1998 with several new titles, perhaps partly in anticipation of its planned initial public stock offering in the first quarter of 1999.

For me, that sounds like a clever way to extend a product I've used with great success. I put on that crummy little headset with the awkward boom mike, wiggle it all around a little, and go. The results are never perfect, but they're faster and more accurate than my typing. Someday it will be more accurate, but NaturallySpeaking's better than good enough today—which is, well, good enough for me.

But why not lose the dumpy headset and boom mike permanently and instead just sit back in my desk chair, put my feet up beside my keyboard, and dictate into the little NaturallyMobile recorder? I could then dump my dictation into the PC and let NaturallySpeaking process it, and *bingo*, I'd have Word 97 files ready for cleanup. This adds a step (manually transferring the WAV file to the PC) but is easy enough with Dragon's simple Voice-It Link software.

Dragon admits privately that recognition accuracy may suffer a little when you use the NaturallyMobile recorder instead of the headset. Perhaps: when I've run recognition-accuracy tests, files created with the recorder were maybe 1 or 2 percent less accurate than with the headset. (Probably because optimum recognition accuracy depends on keeping an absolutely constant lips-to-microphone distance, but I tend to wave the NaturallyMobile recorder around a little when I use it.)

I practically never carry the little NaturallyMobile recorder around with me to record things away from my desk. Maybe in time I will, but not now. For me, the purposive isolation of disappearing into my office, closing the door, and sitting down at my desk is essential to concentrating on my writing. But the recorder sure has made using NaturallySpeaking a lot more comfortable and convenient.

On to Deja News. I'm not a huge fan of newsgroups: there's lots of dross, little gold. And my e-mailboxes are already full, so I don't want anything sent directly to me, and I avoid getting on group lists. But there is useful stuff buried in newsgroups—stuff I need. So for years I've semipatiently gone in with my news reader du jour and trolled through the newsgroups I find useful. Tedious but often worthwhile.

Finally, about six months ago, it hit me that the real value of Deja News, for a user, wasn't the ability to go in and look up old newsgroup postings but the fact that Deja News makes the notion of using a news reader, and spending the time to crawl through newsgroups on a daily or weekly schedule, thoroughly obsolete.

Because with Deja (as its users call it), you can just drop in any time you want, do a nice familiar Web-style search, and find anything and everything that has appeared on what interests you. No more coping with Harleys for sale in *alt.commerce.computers* or those recipes for cookies in *alt.barney.dinosaur.die.die*.

Now I'm back where I was with newsgroups a few years ago—which I count as a good thing. I don't have to waste a lot of time, but I find what I need.

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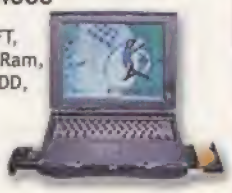

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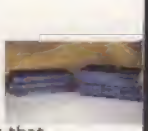

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A Wireless Entanglement

We're on the eve of the personal-area network. Personal computers, PDAs, cellular phones, and the like don't talk to each other, but they should. And they will. Bluetooth (named for Denmark's first Christian king, not a dire dental condition) is a specification first advanced by Ericsson as an extension to GSM, the European protocol for cellular communications. It's a combination of software, communications protocols, and a tiny radio transceiver on a chip that will let devices communicate with one another over short distances (up to 12 metres). Bluetooth devices can communicate at up to 720 kilobits per second, and they can handle phone-quality voice as well as data. Version 1.0 of the specification will be published soon, and the first products are due out by the end of 1999.

There's a lot to like about Bluetooth. It is wireless, can work through walls or from within your briefcase, and is small and inexpensive. The protocols include encryption, and multiple devices—up to 80 of them—can operate in a network.

In a typical scenario, your Bluetooth-equipped cellular phone synchronises the numbers in its memory with the favourites or most frequently accessed numbers in your PDA. Messages arriving on your pager are routinely logged into the to-do list on your laptop and your PDA. Another example has the cellular phone in your briefcase providing an Internet link for your laptop and PDA, so that you can have up-to-the-second intelligence and market information on your desktop, even during a meeting.

Bluetooth also enables some new kinds of devices, such as wireless headsets. You can key a headset to your laptop, cellular phone, or PDA to use voice communications or commands.

It sounds great, and it is. But Bluetooth's greatest strength is its Achilles' heel, too. It uses the unlicensed 2.4GHz band, which is shared by wireless LANs, urban and suburban wireless telecommunications systems, and most notably microwave ovens. Even a properly operating microwave oven can be a jammer for devices that use Bluetooth, because it eats up bandwidth.

Spread-spectrum and frequency-hopping devices can communicate at the edges of the interference, but with greatly impaired throughput. All of the devices on this band have the potential to conflict with one another, but like computers sharing an Ethernet connection, collisions are transitory and result in degraded throughput, not lost data. Every Bluetooth device has a unique ID burned into its chip. Internet proponents wish that this were an IP address, not just a serial number. It could make as-yet-uninvented modes of communication easier.

I would like Bluetooth better if it weren't a radio-only specification. Unless the longstanding ban on intentional transmitters is reversed (which would probably not be a good idea), you won't be able to use Bluetooth devices on airplanes. Also, there is the potential for interference that you can't see or do much about. For instance, you might not want to inhabit the offices directly above or below those of a company that employed a busy wireless LAN. I'd be happier if the same protocols could switch seamlessly to infrared and hardwired communications.

Bluetooth has no operating-system support. Microsoft is not a member of the Bluetooth SIG, because although it has hundreds of members, voting is limited to the five founding members: Ericsson, IBM, Intel, Nokia, and Toshiba. Unless Microsoft is granted voting rights, it won't participate. Intel's Bluetooth marketing manager, Simon Ellis, says this isn't a problem, because Intel is building a driver that will function much like your serial-port driver but will add Bluetooth devices to your range of choices.

If the driver implementation is anything like the unfriendly implementation of USB drivers, Bluetooth could get the cold shoulder from users. There aren't nearly enough software companies in the Bluetooth SIG for my taste; you don't find out the real problems until software gives the hardware a workout. Also, all SIG members must give up any intellectual property they develop for Bluetooth to the group. I find the SIG charter somewhat distasteful: companies contributing intellectual property should have some kind of vote.

Bluetooth security allows for both private and public devices and uses streaming encryption with up to 128-bit keys. Whether the implementation will be transparent or will interfere with the ease of forming ad hoc Bluetooth networks remains to be seen. For more on Bluetooth, check out *www.bluetooth.com* PC

Bluetooth uses the 2.4GHz band, which is shared by wireless LANs, wireless telecom systems, and most notably microwave ovens

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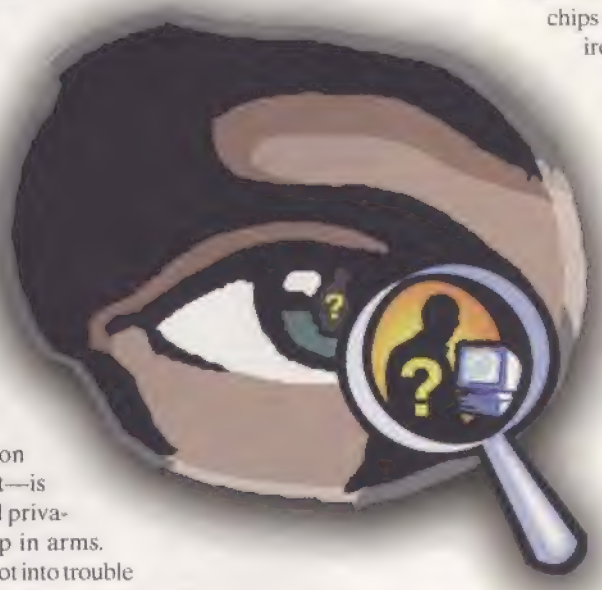
TRENDS

Name, Rank, Serial

Microprocessors are set to play a bigger role in the security arena.

Do you want your computer's microprocessor talking about you behind your back? Soon you may not have a choice in the matter. The trend toward building user-ID technologies into microprocessors—designed to provide a numerical ID, say, when you make an electronic transaction on the Internet—is accelerating, and privacy groups are up in arms.



Intel recently got into trouble with privacy groups, because of the Pentium III's unique processor-identification number that is used to track and validate e-commerce transactions (see "Pentium III Hits 500" in this issue for reviews of the first Pentium III systems). The number helps identify the owner of a chip for a Web site when a transaction takes place and assists Intel in tracking stolen chips. The ID is a 64-bit number within the chip's wiring and is designed to create a 96-bit unique serial number, accessible by software, to identify users. Intel has also produced a software utility designed to let users erase their ID numbers, but that wasn't enough for some privacy groups, including the Electronic Privacy Information Center.

In response to the backlash, Intel scaled back its effort and decided to make the ID's use voluntary. New Pentium III systems will ship with the feature disabled, but customers can turn it on if they want. The topic was a hot one at the recent RSA Data Security Conference. Building security features into microprocessors may be a big benefit to corporations and the software industry, because the copying of software could be policed through IDs built into chips. It raises many questions about the role of hardware in security schemes, however.

Intel has made security into a battle-cry recently, and there are likely to be many other security features incorporated into Intel chips that could draw the ire of privacy groups. "In meeting with many corporate IT managers, we see an incredible amount of concern over the security solutions that are being deployed and whether they're strong enough," said Pat Gelsinger, vice president of Intel's desktop products group, in his keynote address at the conference. "And as these IT managers bring their intranet environments out, they want to know that they're truly secure. We've seen fundamental flaws detected in the implementation of a variety of security algorithms and solutions as they've been deployed, which attacks the fundamental premise by which the new connected world is being delivered."

Gelsinger is adamant that security solutions for enterprises cannot stay restricted to software. "Hardware improves trusted software for security," he said. "Security is only as strong as the foundation it's built on, and hardware resists tampering."

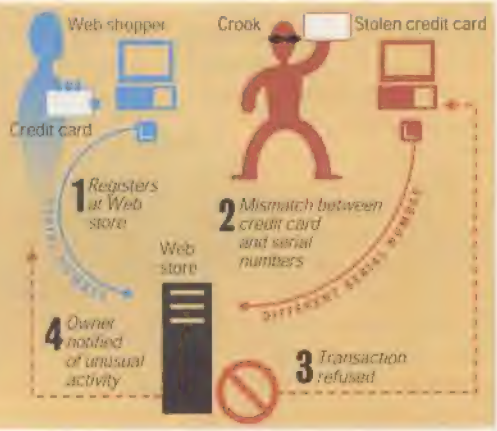
Intel and RSA have agreed to extensive product development and a cross-licensing plan to enhance the security of Intel products over the next three years. RSA's Crypto-C and Crypto-J encryption software solutions are to become key parts of Intel's microprocessor efforts.

Intel isn't alone in bringing security and microprocessors together. AMD (Advanced Micro Devices) is evaluating technology similar to Intel's, though it's not clear yet how it might be implemented. National Semiconductor is working on similar technology as well. Privacy groups are expecting conflicts—similar to the one that arose with Intel—surrounding other electronic ID technologies that may make their way to microprocessors, such as digital-signature technology.

—Sebastian Rupley

Pentium III Police

By building serial numbers into Pentium III chips, Intel can track stolen chips and add an extra layer of security to e-commerce transactions. Here's one possible scenario. A user with a stolen credit card number attempts to buy an item from a Web store, which then tries to authenticate the user but finds a mismatch between the CPU's serial number and the credit card number. The Web store refuses to complete the transaction and notifies the stolen credit card's owner of the unusual activity. Privacy groups contend that use of the serial number is potentially an invasion of privacy.



NEW TECHNOLOGY

A Cellular Piggyback Ride

Here's another spin on the smart phone. Motorola and Starfish Software have come up with a detachable organiser for the Motorola StarTAC cellular phone that stores and displays contacts and schedules. Starfish Software, a subsidiary of Motorola, developed the TrueSync technology used in the REX (a credit-card size organiser) and adapted the software for the StarTAC Mobile Organizer. The 65 gram accessory has a 124 x 136 resolution and uses TrueSync and a serial cable to synchronise your contact and schedule information with Web calendars. Microsoft Outlook, Lotus Organizer, Lotus Notes, ACT!, Sidekick, Palm III, and REX PRO. It works with any analogue, CDMA, or TDMA digital StarTAC phone, but it doesn't work with GSM models.

Because the device snaps on and off, you can speak on the phone while you look at your schedule. (There's not much use in having the display up against your ear.) And you can dial directly from the organiser's address book (Starfish says it will store at least 3000 contacts) or send up to 99 numbers from the organiser to the phone's internal storage. Motorola plans to sell the organiser in the second quarter of the year. A combination package including the phone and Mobile Organizer will also be available, pricing isn't yet finalised.

OPERATING SYSTEMS

We Love You, Linux

In recent months a host of companies have been announcing their support for the popular alternative operating system, Linux. The announcements have given new life to the Unix OS and, for the first time, given Linux supporters real hope in the battle against the Windows monopoly.

Premier database developer Oracle, will have released Oracle8i for Linux by the time you read this. Oracle believes that Linux's strength as an operating system for the Internet will combine well with Oracle8i (an Internet database). The company believes the combination of Linux and Oracle8i will accelerate the development of Internet-based computing solutions.

Software publisher Corel aims to make Linux applications user-friendly by developing an easy to use graphical user interface (GUI) for Linux desktops.

The Linux interface (Corel Desktop Linux) will benefit Linux users looking for a simple to install solution with an inviting and easy-to-use look. The company plans a November release for the interface.

Corel has already released WordPerfect8 for Linux. The company also plans to release Linux versions of WordPerfect Office 2000, CorelDRAW and Corel PHOTO-PAINT. With these Linux products, along with the Desktop Linux interface, Corel hopes to further its quest against Microsoft's monopoly in the OS and office app market.

—Anna Raciti

PROCESSORS

Mattel at Play

Intel has conquered the desktop market and now has its sights set on toyland. The company is collaborating with experts in the toy industry to come up with a new class of toys that draw on the power of the desktop computer. Its objective is to create technologically evolved toys that put high demands on the desktop PC, not toys that have much standalone computing horsepower. The company makes no secret of its motivation to drive sales of desktop microprocessors.

The Intel Play Me2Cam.

By combining its technology expertise with Mattel's play and toy expertise, Intel is hoping that the first entries in its line of Intel Play PC-enhanced toys will grab—and keep—kids' attentions. Rand Potter, who heads up Intel's interactive toy group, recently debuted Intel's initial try at an American Toy Fair. The Intel Play X3 Microscope and Intel Play Me2Cam were designed jointly by a team of engineers and designers from Intel and Mattel. The microscope has a digital video camera, so kids (and adults) can display assorted specimens on their PC screens, magnify them (up to 300x), and save images. The microscope can also be detached from its base so kids can explore the world around them. The built-in camera lets kids create time-lapse movies or photos and then print, e-mail or produce on-screen shows.

The Intel Play X3 Microscope.

With the Me2Cam positioned atop a monitor, kids can see themselves on the computer screen, and a blue screen backdrop enables them to use their own bodies to navigate a virtual world. The system will include a digital video camera and a suite of activities on CD-ROM.

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SECURITY

Thinkpad Tracking

With companies losing millions of dollars every year in portable computing equipment, keeping track of your notebook (and the valuable information inside it) grows more important all the time. To address this problem, IBM recently started shipping its ThinkPad notebooks with Asset ID, a security technology designed to protect your company's portable valuables.

Asset ID combines a radio frequency (RF) ID tag and a hand-held RF scanner to read

and store information about the ThinkPads in a company's inventory, even if the notebooks are unplugged or in cartons. If a notebook is removed without authorisation through a door or passageway protected by an RF sensor, the ThinkPad automatically becomes password-protected. Security personnel can scan notebooks against the ID cards of the people carrying them to detect inappropriate use. They can also shut off the notebooks remotely as soon as unauthorised use becomes evident.

Currently, Asset ID is available only in the IBM ThinkPad 770Z and the 600E, but IBM plans to add the technology to future notebook computers. To take advantage of the new system, companies will have to develop protected environments. This will require the installation of internal antennas, door portal systems, and hand-held scanner devices. Asset ID cannot be installed in earlier IBM ThinkPads, however.

As an alternative security measure, IBM has also announced the Smart Card Security Kit, which contains security software, a smart card, and a smart-card reader that can be installed in a notebook's Type II PCMCIA slot. To disable access, you remove the card. The kit enables password protection, data encryption and decryption, and confidential e-mail with digital signatures. So even if someone steals the computer and discovers the password, the thief won't be able to access the information, because the encryption key is found only in the smart card. —*Sharon Nash*

PRICE CUTS

Casio (Shriro, 02 9370 9100, *www.casio.com*) has reduced the price of the CE-based **Cassiopeia E-11** from $749 to $599, making it one of the least expensive palm PCs in its class. The unit comes with 8MB of RAM.

The popular range of Encyclopaedia Britannica CD-ROMs have been reduced by up to 60 percent in the hope of increasing the company's share in this growing market. The **Britanica CD 99 - Multimedia Edition** has been cut from $299 to $199 while the **Britannica CD 99 - Standard Edition** is reduced from $249 to just $99.

Apple Computer (02 9452 8000, *www.apple.com.au*) has reduced the price of its **PowerBook G3** line to now start at $3995, making the PowerBook one of the least expensive notebooks you can buy with a 14.1in screen.

The **Diamond Viper V550** from Diamond Multimedia (Chips and Bits, 03 9696 1911, *www.diamondmm.com*) has been reduced from $399 to $349. It includes 16MB of RAM.

E-COMMERCE

E-Store

Don't wander around town looking for the best computer bargains—check out the prices at E-Store (www.estore.com.au), the 100 percent online computer shop.

Though most online computer stores are part of a bricks and mortar retail establishment, E-Store has no such physical presence—all transactions are conducted online. And thanks to the low costs associated with setting up an online store, E-Store can offer buyers cheaper than retail prices on most computer products. E-Store offers flexible payment options including an interest free period of six months. Users also have the choice of renting certain products instead of purchasing them outright. E-Store offers secure credit card transactions. —*Anna Raciti*

NETWORKING

A Beginners' Guide

The days when networking was limited to the business market are gone. An ever increasing number of companies are catering to the needs of home and small business users by offering easy-to-use, low-cost solutions.

D-Link (02 9417 7100, *www.dlink.com.au*) has just released the **NetEasy** product range for small to medium business and home users. The range includes a the **DIY DSK-20 Starter Kit** ($216) comprising a 10Base-T hub, two PCI 10Mbps adaptor cards and cables for connecting two PCs. When the user is ready to expand their network, they have access to 10Mbps Ethernet cards, 10/100Mbps dual speed Ethernet cards, and 10Mbps PCMCIA cards for connecting notebooks, as well as 5-, 8- and 9-port 10Mbps or 10/100Mbps Ethernet hubs. —*Anna Raciti*

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Cat. 10100	**Internet Access Server 1 Port**	$459
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100Mbps Network Starter Kit

This kit has all the hardware components required to build a 100Mbps network for two PC's and includes a comprehensive installation manual. The kit includes one 4 port 100Mbps Fast Ethernet hub, two 10/100Mbps PCI Fast Ethernet adapters, two 5 m Cat. 5 network cables & software drivers for the adapters.

Cat. 11900	**100Mbps Network Starter Kit**	$339

10/100 Mbps Ethernet Hubs

Each individual port on these dual-speed hubs provide 10/100Mbps auto-negotiation function which automatically senses and selects either 10Mbps or 100Mbps.

Cat. No. 11310	**10/100 BaseTX Ethernet Hub 5 Port**	$345
Cat. No. 11299	**10/100 BaseTX Ethernet Hub 8 Port**	$639
Cat. No.11298	**10/100 BaseTX Ethernet Hub 16 Port**	$999

10Mbps Ethernet 5 Port Hub & LAN Card

Internal PCI Plug & Play 5 Port hub and LAN card does not require external power supply. One port can be used as an uplink port for easy expansion, or used for hub connectivity at the server.

Cat. 11295	**Ethernet Hub & LAN Card 5 Port UTP 10Mb**	$109

10/100Mbps Ethernet Cards

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Cat 11282	**Ethernet Card PCI UTP/STP 10/100Mbps**	$49
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Cat. 11297	**100 BaseTX Ethernet Hub 4 Port**	$189
Cat. 11281	**100 BaseTX Ethernet Hub 8 Port**	$539
Cat. 11311	**100 BaseTX Ethernet Hub 16 Port**	$889

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Cat. No. 8421	**Infra Red Serial Link**	$147
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PALM COMPUTING

Palm V

You thought you looked so cool tapping away at your tiny **Palm III**, but watch-out—the **Palm V** is here and it leaves previous models looking, well . . . fat.

At 11.4mm thick, the Palm V is nearly half the thickness of the Palm III and it weighs just 113 grams.

The new device includes all the features of previous models—long battery life, easy-to-use Palm OS and quick data synchronisation—while including much more.

The Palm V features a brushed aluminium finish; recessed buttons, and leather front cover. A new high resolution display gives improved contrast and better clarity even in direct sunlight. Contrast can also now be adjusted manually. The Palm V's cradle now also automatically charges your Palm's batteries, so you'll never be left powerless. Left-handed users will be pleased to know the stylus on the latest Palm can slip into the left or right side of the unit.

The Palm V ($999) is sold through 3Com (1800 644 606, *www.palm.com*) —*Anna Raciti*

INTERNET

The Urge to Merge

When Yahoo! announced plans to acquire GeoCities for US$3.58 billion in stock recently, industry analysts stopped to think. With the many portal sites consolidating into a few major players, who's going to come out on top? And do stubbornly independent companies stand any chance at all?

In the recent past, AOL and Netscape joined forces, Disney created the Go Network (and combined it with Infoseek), and Microsoft began pushing MSN with all its might. These moves indicate that few Internet companies dare to go it alone amid the fierce competition for huge audiences and revenues.

Analysts predict that the consolidation trend will continue. "There seems to be a sense of urgency among the major players that size matters. If you can point to a big audience, you have an edge," says Dataquest analyst Peggy O'Neill.

At first, Internet portal companies were eager to acquire sheer numbers to impress advertisers. Now they're realising that random surfers aren't nearly as valuable as return viewers who feel loyalty to particular portals.

The question remains whether there will be room for more than a few players in the fast-consolidating portal market. —*Sharon Nash*

INTERNET

Optus Internet Options

If soaring share prices were a good indication of a company's product and service quality, Optus Cable and Wireless (1800 558 558, *www.cwo.com.au*) would have to rate as one of the country's best service providers. Optus' latest venture, as an Internet Service Provider has proven another successful service, and as such, the company has introduced new pricing plans for heavy Internet usage customers.

The new **NetMaster** plan offers users a hefty 200 hours per month for $45 a month. Additional hours cost only $0.50 extra each. The **NetSaver** option is charged at $10 per month for 4 hours. Additional hours are charged at $2.00 each for the next 24 hours (5th to 24th hour); and $1.00 each for the following 24 hours (25th to 44th hour). Users are not charged for subsequent hours unless they use more than 200 hours. Any hours beyond 200 are charged at $0.50.

The company also offers $10, $20 and $35 plans and Internet Express Pre-paid plans. As an added bonus for loyal Optus customers, Optus mobile, telephony and premium TV customers receive a bonus five hours per month or $5 discount on Internet services. —*Anna Raciti*

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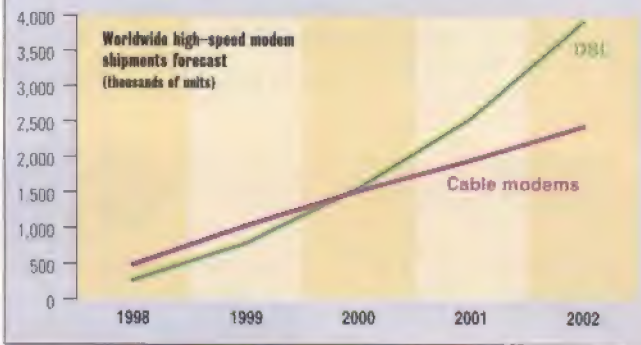
Priced at under $200, the Sola 305 is designed specifically for individual PCs, protecting against power surges, blackouts, lightning, power spikes and power sags. The 305 is compact is size but features five outlets—three uninterruptable power protection outlets and two surge suppression outlets as well as a telephone or modem TVSS.

The 305 is available in 250V, 425V and 600V sizes. —*Anna Raciti*

High-Speed Takeover

In the race for fast Internet access, cable modems are currently in the lead. Preliminary forecasts, however, indicate that sales of digital subscriber line (DSL) modems will overtake cable modem sales decisively by 2002.



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Steve Turvey

More New Processors

We have had a mini-avalanche of new CPUs and inevitably they arrived when all the testing has been completed and the magazine is being sent tothe printers. My column is one of the last items to go so I am writing this and testing the last of the new CPUs just about four hours before my my absolute deadline.

Obviously, due to time constraints, this is not an exhaustive test (*we're* exhausted, but that's another story), nevertheless I tried to run a reasonable spectrum of benchmarks, games and apps to try and discern any performance advantages from the new chips on the block. The first newcomer appears to be a blast from the past: a PGA Celeron 333. Not Socket 7, or even Super 7, a brand new PGA standard designated 370. It is the same physical size socket as Socket 7 but has a smaller pin pitch to fit an extra row of pins in the same space.

Abit has produced its first PGA 370 motherboard and sent us one to test along with a PGA Celeron 333. Ah, but those tricky engineers at Abit also included a little surprise in the package; a cute little daughterboard called SlotKET. SlotKET has a PGA 370 socket and plugs directly into a Slot 1 motherboard. we tried it in the Abit BX6 and our Iwill BD100 Slot 1 boards where it worked flawlessly. However we have no price on SlotKET, if it is cheap enough great, but if the combined price creeps up to that of a Slot 1 Celeron, forget it.

Let's cut to the chase: is there any appreciable performance difference between the PGA and Slot 1 Celerons. That answer is easy: no.

But what about the new AMD K6-3, whose main claim to fame is the addition of 128KB of on board cache (Trilevel cache in AMD-speak) compared to its K6-2 brethren?

AMD appears keen to compare its new baby with the Pentium III, so that's what we'll do. AMD has always been strong in integer tests and the new processor simply cements AMD's lead in this area. In CPUmark 99 it was easily king of the hill and the big surprise was the huge 30 percent lead in 3Dmark 99's CPU test. Strong integer performance generally means, all things being equal, that you would expect strong Winstone performance. The 400MHz AMD was only 1.8 points slower than the PIII 500—a pretty strong case for an inexpensive SOHO system. In the two games we tested, the AMD was pretty soundly caned by the Intel processors, even the lowly Celerons at 333MHz.

Where the Intel products still have the clear advantage is floating point, the PIII almost doubled the scores of the AMD and the Celerons were 30 percent faster. In the multimedia benchmarks the AMD and true-clocked Celerons were neck and neck. Multimedia Mark 99 demonstrates the strength of KNI under optimum conditions but it appears to gain nothing from 3D Now!.

The bottom line from our first round of tests: for serious gamers and high-end workstations, it's got to be Intel. For SOHO and less fanatical gamers (do they exist?) the AMD will probably have the price performance advantage.

Our test rig for Intel CPUs was the Iwill BD100 motherboard, 128MB 100MHz SDRAM, 9GB IBM drive and Viper 550 AGP card. All components were transferred to an FIC PA-2013 Super Socket 7 board for the AMD tests. DirectX 6.1, the latest TNT Detonator drivers and AMD's V3.19 Quake OpenGL drivers were loaded.

Test	Celeron A 333	Celeron 333 (PGA370)	Celeron A 500 (overclocked)	Pentium III 500	AMD K6-3 400
CPUmark 99 version 1.1	25.4	25.4	40.4	38.2	43.3
FPUmark 99 version 1.1	1770	1780	2670	2550	1350
Turok 3D 2	39.6	40.4	58.8	58.8	40.5
Quake 2 640x480	55.9	54.1	71	71.3	49.6
Quake 2 800x600	46.6	46.5	48.2	48.3	44.1
Quake 2 1024x768	28.9	28.9	29	29	28.7
3D Mark2	2708	2736	3870	4039	3091
CPU 3D Mark3	3157	3183	4752	4711	6217
Multimedia Mark 99	787	794	1191	1545	931
MPEG Encoding	810	808	1217	1406	879
MPEG Playback	695	688	1026	1251	880
Image processing	975	975	1310	1770	874
Audio processing	808	963	1212	1747	689
Winstone 99		18.3		23.8	22
3D Winmark				720	530

AMD appears keen to compare its new baby with the Pentium III, so that's what we'll do.

More on the Web:

Read Steve Turvey's Lab Manager Reports exclusively at PC Magazine Online.

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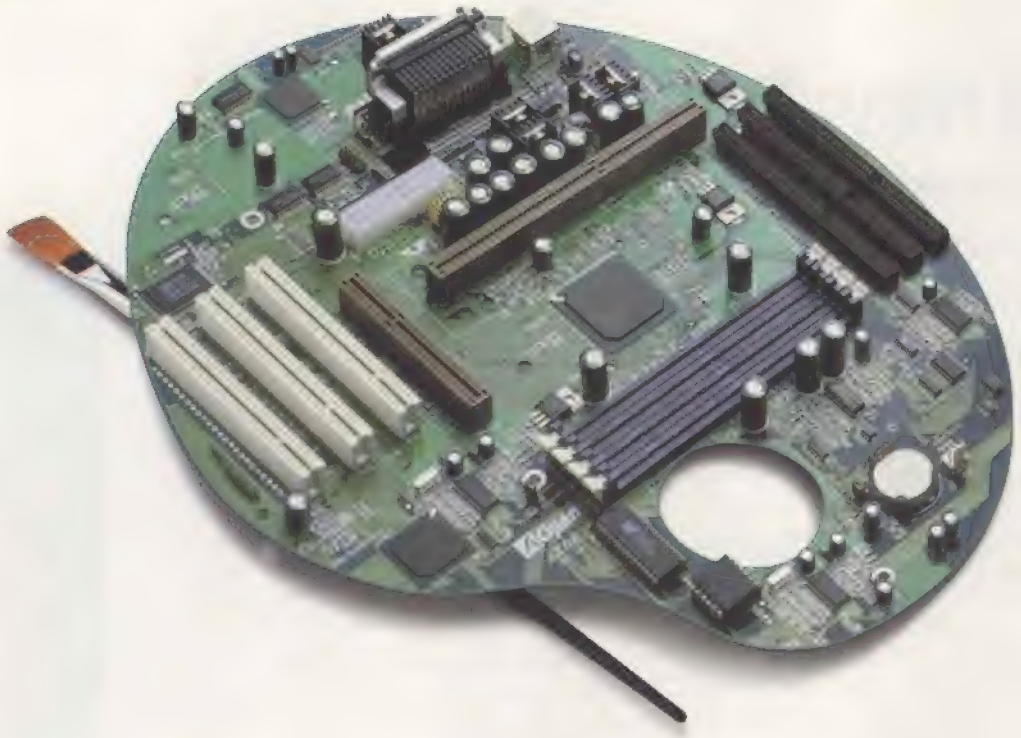

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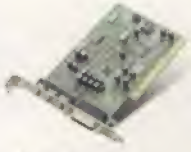
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STORAGE: IOMEGA CLIK! DRIVE

One Size Store All

By Bruce Brown

The long-awaited Iomega Clik! Drive has finally arrived. Using 40MB removable disks, the Clik! Drive is available in a variety of configurations. It may take some time to get used to all the bits and pieces included with the Clik! kits, but relatively inexpensive storage (as little as $23 per 40MB disk), mobility, and connection flexibility make Clik! a removable storage winner.

The 40MB Clik! disks are rated at 700Kbps average sustained transfer rate, with an average seek time under 25 ms and spin at 2941 rpm. The tiny disks (one of which is included with each drive) weigh about 14 grams and measure 2 by 50 by 55mm (HWD). Additional disks sell for $229 for ten. Each Clik! disk comes in a protective plastic case and, although the drive and disks are portable, each disk must be transported in a case, not in a drive, to protect both the media and the drive. The Clik! Drive for Digital Cameras ($599) comes with photo-printing software and a flash card reader with slots to read CompactFlash and Smart Media memory cards. The tested Clik! Drive Plus ($699) adds a Type II PC card with separate interface cable, rechargeable battery and the Desktop Docking Station. You don't have to run the Clik! drive on its battery power, but you should keep the battery attached to the drive, otherwise the exposed metal contacts could cause damage to the drive. The battery recharges in 1.5 hours and is rated for 30 minutes of continuous data transfer.

MINI-STORAGE: *The Clik! Drive and 40MB disks offer low-cost portable storage.*

Clik! disks aren't meant to compete with hard disks or with classic Zip disks. Rather, they're a less expensive alternative to pricey CompactFlash memory, whose costs vary widely but are at least 10 to 15 times more per MB.

You can hook up the Clik! Drive to a PC parallel port, just like a Zip Drive (but you can't daisy-chain Zip and Clik! Drives on the same port). This establishes a transfer path to use after data is stored on a Clik! disk from another source.

You can use the Clik!'s PC Card interface to attach to your laptop. During installation, the PC Card is recognised as a standard ESDI/IDE drive controller. With either parallel or PC Card connections, the Clik! Drive is visible in My Computer and via Windows Explorer as a standard removable media drive.

The Flash Memory Reader, which ships with the Digital Camera and Plus bundles, is a plastic module that clips on the bottom of the Drive. It has separate slots for CompactFlash and SmartMedia cards—the two most common digital camera image-storage standards.

To transfer files from flash media to a Clik! disk, simply insert a piece of media into the Flash Memory Reader, push a button on the reader, and watch the LCD screen track the transfer process and report the percentage completed. (Note that the Flash Memory Reader is only for one-way data transfers to Clik! disks.)

You can only use the Flash Reader when the Clik! Drive is running on battery power. If you carry the Clik! Drive (with battery and Flash Memory Reader attached) with your digital camera, you can pause whenever you fill a SmartMedia or CompactFlash memory card to upload the images to the Clik! disk and free up space on the flash media.

The greatest advantage of the Clik! Drive is versatility: it lets you connect to and transfer information quickly and easily from desktop PCs, notebooks, Windows CE devices, and digital camera media. Add the Clik!'s portability and relative low cost and you have a great new device to add to your information-handling arsenal.

Iomega Clik! Drive Plus. Price: $699. Requires: 16MB RAM; 25MB hard disk space; Microsoft Windows 95, 98, or NT 4.0. For Windows CE 1.0 or 2.0, 600KB RAM storage space. Iomega: Ph: 02 9955 2455, Fax: 02 9955 9545; www.iomega.com.au

REPORTING: SEAGATE CRYSTAL REPORTS VERSION 7

Ace Reporter

By Stephen W. Plain

Long ago, Seagate Crystal Reports ($690), from Seagate Software, earned its stripes as a top-notch solution for ad hoc reporting and software development. Version 7 features a long list of enhancements that extend its flexibility, accessibility, and power.

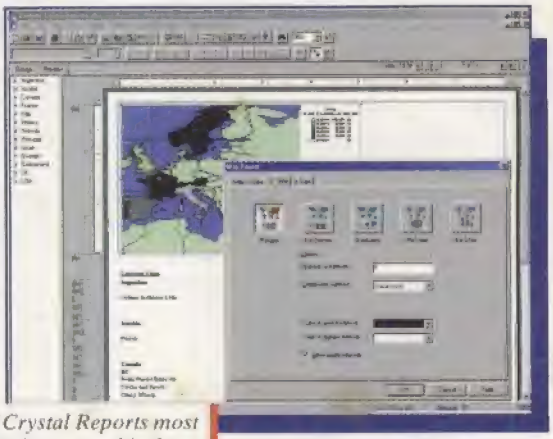
A significant new feature is geographic mapping. Map Expert helps you insert and link maps into your reports. During testing, we were able to insert maps into existing reports easily and quickly.

Another major addition to Crystal Reports is the Java-based Crystal Query, which lets anyone with a Web browser perform ad hoc analysis. Crystal Query uses a triple-paned dialog with database-table, query, and results sections. Drag-and-drop query design and the ability to switch quickly between design and preview modes make this tool very approachable and powerful.

Crystal Reports offers comprehensive native and ODBC database connectivity that is almost guaranteed to work with your data source. This version adds support for ACT! 4.0, OLE DB support, and ODBC access to Oracle 8.*x* databases. The program is also keeping up with the popular development environments, with a new JavaBean and VCL component to support Java and Delphi development.

Another new feature is On-Demand Subreports, which lets you define several subreports within the primary report but avoid processing them unless you select their icons. Also, you can now highlight currency and number fields based on custom criteria.

Document Import Tool, also new, gives Crystal Reports the ability to input ASCII reports from legacy databases and reverse-engineer them into Crystal reports. Once the tool analyses the text, you can generate a report and remap the data fields. Although this enterprise tool takes a little time to warm up to, its colour-coded interface makes the process as painless as possible.



MAP IT: *One of Crystal Reports most visible additions is geographic data mapping via the new Map Expert.*

Today's PC-based reporting tools must address not only data-source compatibility but also development platforms and end-user environments. Crystal Reports continues to evolve and remains the king of the hill in this category.

Seagate Crystal Reports Version 7. Price: $690. Requires: for 16-bit version, 16MB RAM, 108MB hard disk space, Windows 3.1 or later. For 32-bit version, 16MB RAM; 148MB hard disk space; Windows 95, 98, NT 3.51, or later. Aeronaut Industries; Ph: 02 9436 1175, Fax: 02 9436 1184; www.seagatesoftware.com

GRAPHICS: COMPAQ TFT 8000 LCD DESKTOP MONITOR

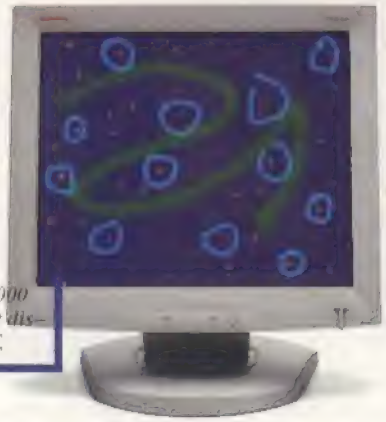
Big Screen, Small Footprint

By Alfred Poor

Sit down to work with a new 18.1-inch diagonal Compaq TFT8000 LCD desktop monitor ($7195) and you may feel as if you're staring at a billboard instead of a PC screen. It fills your view without taking over your desktop, but the TFT8000 may eat up your budget.

The active-matrix LCD panel uses *in-plane switching*—the liquid crystal cells are at right angles to traditional designs—to improve off-axis image quality. Compaq claims you have a 80-degree off-axis view in both vertical and horizontal planes; we observed that image brightness drops off rapidly as you move to the side of the screen, but the image remains sharp.

With a native resolution of 1280 x 1024, the monitor can handle resolutions down to VGA. The scaling is extremely effective, and though some characters may look a little fuzzy at lower resolutions, text and images are readable and have few scaling artifacts. The only problem is that standard lower resolutions use an aspect ratio of 4:3, but a 1280 x 1024 resolution uses a 5:4 ratio; as a result, objects look slightly stretched vertically at lower resolutions.



WHAT A VIEW: *The TFT8000 gives you the equivalent display area of a 21in CRT.*

We tested the display using images created by DisplayMate from Sonera Technologies (*www.displaymate.com*), and with a few exceptions, the quality was excellent. The on-screen display (OSD) made configuration relatively easy, and the

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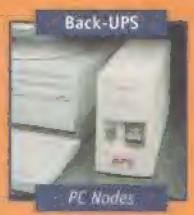

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images were mostly rock-steady, though we were not able to remove pixel jitter at all gray-scale levels.

Horizontal and vertical lines were of equal thickness and brightness, and there were no apparent cell defects, which is remarkable given the number of pixels in the panel. The only significant fault was a sudden drop-off of shades of grey or colour at the low end: the darkest shades were black.

The image is roughly equivalent to that of a 21in CRT display, yet the TFT8000 weighs just 9kg, in contrast to the 30 or so kilograms a CRT weighs. Compaq has targeted the TFT8000 primarily at financial markets where space is at a premium; the monitor is also intended for executive and high-profile applications. Compaq provides a one-year warranty on labour and a three-year warranty on parts, including the backlight.

Since Windows can work easily with multiple monitors, the question of value enters in. Two 15in 1024-x-768 LCD monitors in portrait mode cost less than $2000 apiece yet provide about 20 percent more pixels, at a saving of nearly 40 percent.

So although the Compaq TFT8000 is big, bold, and beautiful, there may not be a huge market for it. Users willing to consider spending this much on a display may want to think about some alternatives that will deliver similar results at a lower price.

Compaq TFT8000. Price: $7195. Compaq Computer; Ph: 02 9911 1999; Fax: 02 9911 1900; www.compaq.com.au

GRAPHICS: ADAPTEC VIDEOH

Video Capture Made Easy

By Jan Ozer

If you're seeking to bridge the gap between your computer and your camcorder, Adaptec's VideOh can help. This $650 device captures high-quality MPEG-1 video and still images, and is a breeze to set up.

VideOh is in fact version 2 of FutureTel's highly regarded Video Sphinx encoder, now exclusively distributed through Adaptec. The chequebook-size device attaches to your computer's ECP parallel port, which eliminates the need for a PCI capture card and lets it be used on most new laptops.

VideOh is a good choice for hobbyists looking to share their videos on disc or over the Net.

The unit has inputs for both S-Video and composite video, and a stereo audio source. Audio is captured in hardware for improved synchronisation. Still-image and video-capture operations are controlled by Adaptec's ClipView software, which uses simple VCR-like commands. ClipView lets you preview the incoming video and provides controls for adjusting hue, saturation, contrast, brightness, and audio volume.

Also included in the package is Adaptec's Easy CD Creator Deluxe edition for storing videos to CD-R or CD-RW. Macromedia's Backstage Web-development software, and MetaCreations' Kai's Photo Soap for editing still images.

Capture resolutions include both quarter-screen and postage-stamp-size videos at data rates ranging from 1.5MB per minute—suitable for distribution on the Web—to about 20MB per minute for high-quality desktop video.

Still images can be captured at resolutions of up to 1600 x 1200 and saved as BMP, JPEG, PCX, or TIF files.

After video capture, you trim unwanted frames in ClipView's Trim panel and connect clips using the ClipGlue module. ClipGlue also lets you insert titles at the beginning of your videos, and fade in or out—both simple but useful functions. Other modules include video e-mail and MediaShow, which sequences still images and videos into simple presentations.

We tested VideOh with a variety of footage, from talking heads to highly detailed motion. Overall, we were impressed with the video quality, which came through with minimal noise and clear, perfectly synchronised audio—even on clips up to 20 minutes long.

Captured still images generally exhibited fine detail and good colour quality, although images captured from high-motion video clips showed some slight blurring. This was probably due to VideOh's so-so antialiasing filters. Still-image quality peaked at 640 x 480, which is more than sufficient for Web use, and appeared slightly pixilated at 1600 x 1200.

MPEG-1 playback is ubiquitous on Windows, Macintosh, and Unix platforms, making it an ideal format for presentations or Web distribution. Factor in VideOh's impressive software bundle and still-image capture capabilities, and you have a solid offering for professionals and video enthusiasts.

Adaptec VideOh. Price: $650. Agate Technologies. Ph: 02 9870 4688; Fax: 02 9878 4655; www.adaptec.com

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DEVELOPMENT: SUN MICROSYSTEMS' JAVA 2 SDK

A Second Cup of Java

By Rich Dragan

The Java 2 SDK, from Sun Microsystems, puts unprecedented programming power into the hands of Java developers and gives enhanced functionality to end users. The new Java standard appears to be the richest ever, though end users may have to wait to reap all the benefits promised in this release.

The most visible improvement in Java 2 is its set of classes that lets programmers create highly graphical applications and applets. These so-called *Swing* classes provide a library of widgets from sophisticated objects such as trees, tables, and graphically rich controls that rival the features of "native" operating systems such as Windows 98/NT and Unix. Better yet, these Swing classes have a pluggable look and feel, which means that a Java application can change its appearance to mimic Windows or Unix's Motif on the fly.

Developers can even create their own visual styles. This chameleon-like flexibility will be a winning feature to vendors who are considering writing a Java application that needs to run on more than one OS or hardware platform.

Along with the Swing classes, additional features that will let Java programs compete alongside native versions include the ability to drag and drop files across Java 2 applications and greatly improved 2D graphics capabilities for real-time graphics and animation. In short, whatever native applications can do, Java 2 applications can do just as well, in functionality if not performance.

To test performance, we ran our JMark 2.0 Java benchmark test against the previous release of Java (JDK 1.1.7B). We saw only a one and three percent increase in performance on our Processor and AWT Playback (graphics) tests, respectively; almost all other tests showed a modest decrease in performance.

Sun claims performance enhancements to the Java 2 release include faster garbage collection and many optimised "core" classes, better synchronisation, and native support for threads for Sun Solaris. (Our benchmarks don't test these new features.)

Under the hood, Java 2 adds new features that will keep corporate developers happy as they write applications for the new millennium. There are a richer array of container classes for common data structures, like linked lists and maps. This addition makes up for the relatively weak support for containers in earlier versions of Java. Now Java programmers can choose just the right container to fit the problem at hand.

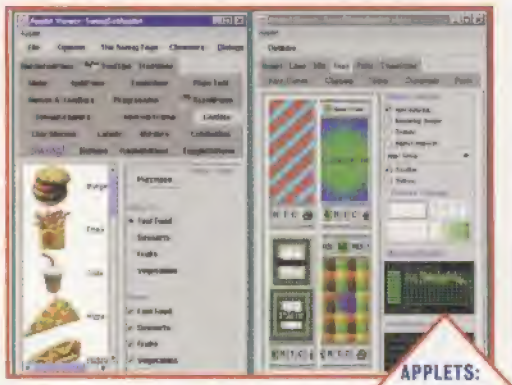
For database and enterprise developers, Java 2 includes Version 2.0 of the Java Database Connectivity (JDBC) standard for connecting to corporate data. Already a successful standard backed by many vendors, JDBC 2.0 adds support for bidirectional cursors (for scrolling through data forward and backward), batch updates, and new support for SQL3 data types. Support for CORBA is also included as standard equipment with Java 2.

Security is an important enterprise concern, and the new security model in Java 2 is one of its most improved features. Early versions of Java used an all-or-nothing approach, in which Java applets were restricted from local file access (or even printing) by running in a Java sandbox.

The new approach to security uses standard X.509 certificates to authenticate what a Java application can and cannot do, using a sophisticated and finely grained policy-based security model. This means that administrators can easily grant permissions to Java applications to corporate resources like database servers and printers, while preventing wayward behaviour.

In the midst of its lawsuit with Sun, Microsoft has no immediate plans to support the Java 2 standard. For now, in order to see Java 2, you'll have to rely exclusively on Sun's JVM (included in the Microsoft Navigator Java 2 SDK).

The good news is that, via a plug-in, Java 2 will run on In-



APPLETS: *Java 2's 2D API provides rich 2D graphics for the next generation of Java applications.*

PERFORMANCE TESTS

JMark 2.0

The JMark 2.0 program tests the performance of the Java Virtual Machine you might find inside a Web browser. JMark includes tests for both the processor and graphics (AWT) subsystems. We tested on a Pentium/200 PC with 64MB of RAM, running Windows NT 4.0. For more on JMark go to *www.zdnet.com/zdbop/jmark/jmark.html*.

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Better plain paper performance. Then there is P-POP (Plain Paper Optimised Printing), a process unique to the new BJC-7100. It bonds an invisible Ink Optimiser to the paper before inks are applied. The inks, in turn, bond to the optimiser. Plain paper text and lines are better defined, colours are more vibrant, tones are sharper, and print-outs become virtually water fast.

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Water Resistance

Better paper handling, full bleed A4. Better plain paper use can obviously lower operating costs. It accepts virtually all paper types from plain to high gloss photo paper, has the ability to print full-bleed A4 and even accepts card-stocks at paper-weights up 550 gsm (0.8MM).

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ternet Explorer and Netscape. When we tested sample pages that made use of Java 2 code, we found that downloading the 9MB plug-in worked reasonably well, though this initial download took a few minutes even on a fast corporate LAN.

Java 2 raises the bar for Java functionality and re-asserts Sun's control of the platform for the near term. In a perfect world, all vendors should be striving to keep up with the latest and greatest in Java functionality, represented by the new Java 2. For developers, it's the best Java we have, though the benefits for end-users are still to be seen.

Java 2 SDK. Price: Free download. Requires: 32MB RAM; 30MB hard disk space; Microsoft Windows 95, 98, or NT 4.0. Sun Microsystems, Ph: 02 9844 5000; Fax: 02 9418 2016; http://java.sun.com

PCI SOUNDCARDS

Sound Investments

By Steven Turvey

Only two of the three cards in this First Look are directly comparable, the Diamond MX300 and the SonicVortex2 from Videologic. The remaining offering from Videologic, the Sonic Storm Pro, is more an introductory level card and is certainly not as high on the evolutionary ladder as the others.

At the heart of the Pro is the ESS Maestro 2 sound engine with the Pro appellation indicating the next step up from the first Sonic Storm card which featured the Maestro 1. The new Aureal Vortex 2, yes Aureal of A3D fame, powers the other two cards and, to be blunt, is certainly a step up from the Maestro.

Videologic's SonicStorm Pro

Videologic SonicStorm Pro

This small card has a good range of connectors with four internal connectors for CD-ROM, DVD and the like. Externally the card sports a midi/game port, separate line-in and mic-in, and a stereo line-out. For the purist the Pro has a digital S/P-DIF output jack.

The Pro supports DirectSound 3D and boasts Sensaura HRTF 3D positional sound, but no A3D.

Games performance was very good, for example the sound in motocross madness was quite atmospheric although it did not seem as realistic as the two A3D cards with their four speakers. The "bizarre" 3D sound demo illustrated the 3D capabilities and was very convincing, though with only a single stereo output it must use two speakers to simulate surround sound. So when an object goes behind it actually seems as if it passes just in front of you.

Hardware MIDI is very good. It is certainly more than adequate for games but for music purposes we found some of the samples a bit off, even when using the largest 4MB samples provided. However, if you are serious about music, simply run the hardware midi for games and then select the Yamaha ZG software synth for your compositions. The Yamaha samples are more realistic.

Videologic SonicStorm Pro. Price: $149. Videologic. Ph: 1800 067 722; Fax: 03 9722 2104; www.videologic.com.

Diamond Monster Sound MX300

Given the small size of the Vortex2 chip and the relatively low support-component count, the MX300 is certainly a large board with scads of spare real-estate. Even so you must purchase an additional daughter board, which plugs into the MX300's appropriately named MX-Link connector, to get your S/P-DIF connector. In addition to the MX-Link connector the card also features an internal connector for a wave table daughterboard and three other connectors for 64 voice Hardware & 128 voice Yamaha XG softsynth.

Diamond's Monster Sound MX300

Videologic's SonicVortex2

CD-ROM, Modem and DVD for example. External connectors, including the midi/joystick port, are classy looking with a gold finish and, in addition to the two outputs to drive true four speaker surround sound, the card has a pair of line-in and mic-in jacks.

It comes as no surprise that in addition to DirectSound 3D the MX300 also supports the excellent A3D positional audio standard.

We could not fault either of the Vortex2 based cards in the games tests. Even with the action coming thick and fast, the cards provided excellent depth and sound accuracy and, if a nasty did try and sneak up behind you, that's exactly where the sound appears to emanate from. Mind you, finding a true quad surround sound amplified speaker systems will not be an easy task. For our testing we attached a set of Creative Cambridge Studio Works speakers.

Hardware and software midi are a bit of a blur with most modern cards, you are generally unsure which you are using. However, at all times the quality of the instrument samples were very good and this card would give a Sound Blaster Live a run for its money.

Diamond Monster Sound MX300.

www.zdnet.com.au

1440 DPI, PhotoRealism, richer blacks, exceptional speed, plus

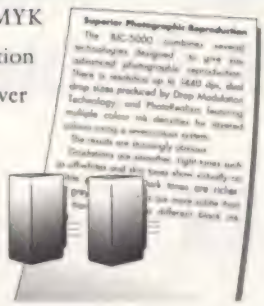
independent cartridges.

The idea of a dual cartridge system has existed for awhile. But needless to say, some systems are better than others. The new BJC™-5000 proves this point.

1440 dpi with variable ink drop sizes. Both the standard colour and optional PhotoRealism™ cartridges use Canon's Drop Modulation Technology™ with variable drop sizes in resolution up to 1440 dpi. The combination delivers smoother colour gradations and far less "grain" on virtually all paper types.

New dual-cartridge system enhances performance. Then, a special dual cartridge system lets both cartridges act independently to complement each other. In "split-page mode" identical black or colour cartridges can effectively double print speeds. Or, using different ink types you can produce exceptional quality effects, with the printer automatically identifying and using each cartridge for the desired result.

90 times more colour combinations. For instance, PhotoRealism inks can be used with conventional inks for a seven-colour ink system, with multiple ink densities per pixel for up to 90 times the colour combinations of conventional CMYK inks. Combined with Drop Modulation Technology the result approaches silver halide quality reproduction.



An all-new approach to black. It uses new, black ink that is blacker than conventional ink. As a result, black & white documents have an exceptionally high degree of finish. Two of these cartridges (BC-23) are included in the box, and may be used simultaneously.

Independent print heads can halve print time.

Print up to A3. Both standard and PhotoRealism inks may be used on all A4 paper types. It will also print up to A3, and supports banner printing to the equivalent length of 6 A4 pages.

Canon Customer Care. All Canon printers feature a one-year warranty, upgradeable to three years for minimal cost, and are backed by unlimited hot-line support. To learn more call us on 1 800 021 167.

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CS6002

Price: $269. Chips and Bits. Ph: 03 9696 1911; Fax: 03 9696 1942; www.diamondmm.com. 64-voice hardware plus an additional 256-voice softsynth.

Videologic SonicVortex2

Videologic managed to squeeze the Vortex2 and its attendant connectors on a much smaller board than Diamond, apparently without sacrificing any features. Indeed, they managed to provide an external S/P-DIF along with two line-outs (for four speaker support), a line-in, mic-in and midi/joystick port without resorting to a daughterboard. Internal connectors, with the exception of the Diamond's MX-Link are identical to the MX300.

Positional sound support is also identical with DirectSound 3D and A3D support.

We found it pretty much impossible to separate the two in the games tests with the SonicVortex2 exhibiting the same depth and audio quality as the MX300. As previously mentioned even when the action was thick and fast the card did not seem to miss a beat which is hardly surprising given that the Vortex2 chip can simultaneously cope with 16 distinct 3D sources and up to 60 3D reflections. Midi quality was also a photo finish and none of the Labs staff could agree on a winner in this category, it almost came down to what side of the bed you got up on.

Videologic Sonic Vortex2. Price: $239. Videologic; Ph: 1800 067 722; Fax: 03 9722 2104; www.videologic.com. 64-voice Hardware plus an additional 256-voice softsynth.

Summary

If you are on a very limited budget then obviously the two Vortex offerings will probably be out of your reach, remember you will also need a four-channel amplified speaker setup to get the most out of these two. The Sonic Storm Pro will merrily generate a limited 3D experience out of a pair of speakers and at a considerably lower price.

If you want true surround sound and have slightly deeper pockets then which do you buy, the MX300 or the Sonic Vortex2? They are both pretty much mirror images as far as features and performance is concerned, unless a standard S/P-DIF connector is a concern. So the answer is simple, which ever you can buy cheaper and/or with the software bundle that suits you.

INPUT: LOGITECH MARBLE MOUSE

A Marble-ous Idea

By Scott A. May

Give your wrist a rest and let your fingers do the walking with Logitech's Marble Mouse, an input device that looks like a mouse but works like a trackball. The $99 Marble Mouse is a solid performer, and a sensible choice for desktop users with tight space, for notebook users, or for people merely looking to change their mouse habits. And because it's completely symmetrical, it is equally well-suited for both right- and left-handed users.

The Marble Mouse uses the same optical-sensing technology as Logitech's popular TrackMan Marble series. A large red marble nestles in a cavity near the back of the unit. The sphere is speckled with tiny black dots, which are read by an optical sensor at the base of the cavity. The marble moves freely in all directions, as if floating on air, providing fast and effortless cursor movement. Since it operates like a trackball, your wrist doesn't move, but your index and middle fingers get quite a workout.

Proportionately equal on both sides, Logitech's Marble Mouse is for right- and left-handed users.

The mouse-shaped device measures 43 x 86 x 165mm (HWD) and comes with a generous 1.6 metre cord. The unit ships with a 9-pin serial adaptor for its default PS/2-mouse-port plug. Surprisingly, Logitech neglects to include drivers for mouse functions, so you'll have to use standard Windows drivers or download Logitech's MouseWare drivers from the company's Web site. It's a moot point anyway, since the extent of the device's programmability is simple chording; you press both buttons to simulate double-clicking on a mouse. Otherwise, operating the Marble Mouse is straightforward.

If your computer has multiple input ports, you can use the Marble Mouse in conjunction with your regular mouse. Switching between the two devices isn't an ideal solution, but it may be helpful if you're used to the scroll-wheel feature found on many newer mice.

At its default setting, the Marble Mouse tracks well, traversing the entire width of the screen per inch of marble movement. The speed can be adjusted through the software—an important feature for graphics professionals, who require precise movement. In our experience, however, the device often undershot or overshot the target.

The Marble Mouse is a comfortable alternative to a traditional mouse. Its sleek styling and stationary operation are sure to please users with strong ergonomic preferences. Nevertheless, the product's limitations may be frustrating to users accustomed to input devices with more functionality. Our advice: try before you buy.

Marble Mouse. Price: $99. Logitech: Ph: 02 9972 3711; Fax: 02 9972 3570; www.logitech.com.

Canon's patented new LIDE technology helps these new scanners

break the price/quality barrier.

Reinvent is the most over used word in the computer business. But this time it's true. Canon has just reinvented scanners.

And not a little bit, but completely.

Introducing LIDE.™ Using a new, patented technology called LIDE (LED Indirect Exposure), we have fundamentally changed the way scanners work, and their price/performance ratio.

LIDE eliminates the need for costly, complex optical mirrors in image acquisition, while it maintains superior image quality and colour clarity.

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The new CanoScan™ FB 320P and FB 620P offer a choice of 300 or 600 dpi optical resolution, plus enhanced resolution up to 2400 dpi* and 30-bit colour acquisition as standard.

Full software suite. Both come with everything needed to begin scanning immediately. The CanoCraft CS-P software works for both stand-alone image acquisition, and as a TWAIN driver for other applications. It features new, easier to use controls, and advanced controls for colour matching and image definition. Also included are PhotoExpress for image editing and OmniPage LE for OCR, a CD-ROM with full tutorial and user's manual, a parallel cable and power supply.

LIDE LED Indirect Exposure

Canon Customer Care. The FB 320P/620P scanners feature a one-year warranty upgradeable to three years for minimal cost, and are backed by unlimited hot-line support.

The new CanoScan FB 320P and FB 620P. You can see they are different at first glance. To learn more call 1 800 021 167.

Photo Realism

FB 320P – Now $199[RRP]
FB 620P – Only $299[RRP]

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IMAGING: MINOLTA DIMAGE EX1500

Modular Megapixel

By Daniel Grotta and Sally Wiener Grotta

The Minolta Dimâge EX 1500 ($2495) is the first consumer digital camera that is upgradable and has interchangeable lens capability. It comes with a variety of useful features and functions designed for business users and semiprofessional photographers. What's more, image quality is the best we've seen in this class.

The Dimâge EX is available in two models: the EX ZOOM 1500 has a 3:1 optical power zoom, and the EX WIDE 1500 has a high-speed (f1.9) wide-angle lens with a coverage equivalent to a 28mm lens on a 35mm camera. For an additional cost , you can have both lenses. Either lens unit can be detached and replaced with the other lens, a serial interface, or other to-be-announced peripherals.

The Dimâge EX uses Digita, FlashPoint's built-in OS, which makes setting up and shooting relatively easy and versatile. For instance, instead of one-size-fits-all exposure compensation, users can select pro-like half-stop and full-stop bracketing. The camera also features time-lapse photography, full- or quarter-frame size, two auto-focus settings, and auto-rotate.

Using the Dimâge EX is simple, as long as you respect its quirks. The motorised zoom lens is noisy, making candid shooting a problem. Not only does the lens extend so far that it clips a corner of the viewfinder in wide-angle mode, but the UV filter is flush with the bezel, making fingerprints on the lens unavoidable.

The optical viewfinder displays less coverage than the camera actually captures. The LCD viewfinder is grainy, jerky, and virtually impossible to see in bright light. In addition, we weren't able to check accurate focus in macro mode. Because the CompactFlash memory card is next to the batteries on the bottom of the camera, the batteries will fall out if you're not careful when you open the compartment.

CHANGE IS GOOD: *The Dimâge EX accepts a zoom or wide-angle lens.*

There's practically no delay between pressing the shutter and capturing an image. The Dimâge EX's large 16MB buffer makes it possible to capture up to seven images in two seconds (sans flash, of course).

Where the Dimâge EX excels is in image quality. The camera has a resolution of 1344 x 1008 pixels; users can select from three compression levels plus an uncompressed JPEG that interpolates a raw 1.4MB file up to 3.8MB. Images are exceptionally crisp and sharp, with accurate and pleasing colours. Better yet, the dynamic range is superb—as good as some pro digital cameras—capturing details in dark shadows and bright highlights.

Versatility, simplicity, and excellent images, plus true interchangeable lenses, put the Dimâge EX at the top of its class.

Minolta Dimâge EX 1500. Price: $2495. Minolta: Ph: 02 9370 8917; Fax: 02 9370 8991; www.minoltacamera.com.au

INTERNET: NETOBJECTS FUSION 4.0

Robust Web-Site Builders

By Edward Mendelson

Web site–builder software helps you to create industrial-strength Web sites, complete with database access, in a WYSIWYG environment: you drag and drop page elements to an editing screen, and the software generates coded pages and uploads them to your server. NetObjects Fusion 4.0 is a robust new version of the two superior programs in this category.

Unlike a traditional Web-page editor, this program uses proprietary formats during the editing process, generating HTML code only when you're ready to preview or publish your site. Fusion is best at graphics-intensive design.

NetObjects Fusion was the first WYSIWYG site builder, and Version 4.0 ($569) benefits and suffers from the program's history. Benefits include 55 dazzling, mature graphics styles for buttons, borders, and other visual elements.

New features include table editing, Java-based drop-down navigation menus, and such JavaScript features as automatic redirection according to the browser used. But Fusion wasn't designed for the dynamic database connectivity features that the new version supports through awkwardly implemented add-on connections with Allaire's ColdFusion or Microsoft Active Server Pages.

The program's strength is still in graphics and layout. Each site has a customisable graphics style that can be changed or replaced with a few mouse clicks, and the changes propagate automatically throughout the site, though individual pages can have their own graphics styles.

Fusion's pixel-level control of text and graphics positioning appeals to traditional, paper-based graphic design-

It was already Australia's most popular printer for home and small offices. And now it's even better value than ever.

Use 75% less ink. Super Economy mode reduces ink consumption by 75% compared to Standard mode, and works for both black and white and colour. Combined with a high capacity, black ink cartridge, it can print up to 2400 pages in black and white, and up to 600 in colour using standard inks*. That's anywhere from two to five times the output of any direct competitor!

Fast B&W plus photo quality printing. Then, there is a choice of high-speed B&W, or three colour print modes – Normal, Fine and Photo. Photo mode emphasises highlights and contrasts, and improves half-tones by producing a richer process black.

Brilliant colour, super economy, optional PhotoRealism, improved Internet printing,

now all for just $159.

Optional PhotoRealism!™ To this Canon adds the option of PhotoRealism inks, for photographic reproduction approaching silver halide quality. By layering inks in up to four densities, it produces up to four times the colour combinations of conventional CMY printers, for smoother colour gradations and more accurate colours in skin tones and other light shades.

Better Internet images. Image Optimisation takes low resolution Internet images (typically 72 dpi), and prints them at the highest resolution supported by the printer to reduce jagged edges and pixelisation.

Canon Customer Care. All Canon printers feature a one-year warranty, upgradeable to three years for minimal cost, and are backed by Customer Care hot-line support. Drivers are available for Windows® 3.1x/95/98 and Windows NT.

The BJC-255SP includes full capacity black and colour print cartridges, for just $159. For more information call 1 800 021 167.

Photo Realism

BJC-255SP colour Bubble Jet™ printer – $159 RRP

Canon

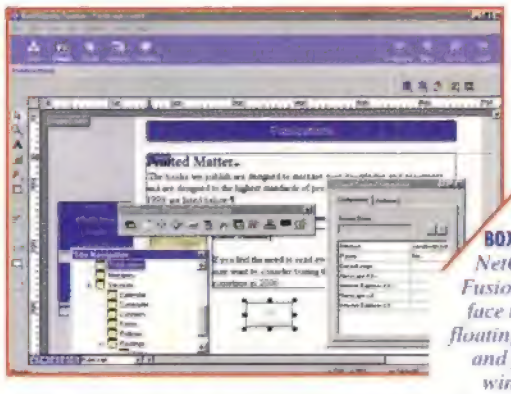
* Based on 5% page coverage. Super Economy not available with PhotoRealism inks. Price shown is the recommended retail price including tax. Canon and the Canon logo are registered trademarks and BJC, Bubble Jet and PhotoRealism are trademarks of Canon Inc. Windows is a trademark of Microsoft Corp. in the U.S. and other countries. Canon Australia Pty Ltd ACN 005 002 951

CS6012

ers, but it can be a mixed blessing for Web design. For example, by default, the program places a text-only navigation bar in a fixed location at the foot of the page (in addition to a graphics-based bar on the left), so your site will look its best only if a visitor's browser is sized correctly.

You build pages in Fusion by clicking on a tool icon, then drawing a box on the page to contain a page element, which can be anything from a plain text box to a third-party JavaBean. Confusingly, you also draw boxes on the page to insert invisible elements such as JavaScript.

The most outdated feature of the interface is its inability to display multiple views of a site in separate windows. You have to switch through separate site, asset, style, and page views, although a pop-up window lets you navigate the structure of a site while editing. Worse, when you change a page title in the page editor, the page isn't renamed in the site view, making it almost impossible to find the page you want.



BOXED IN: *NetObjects Fusion's interface includes floating toolbars and pop-up windows; invisible page elements are displayed as boxes during editing.*

Fusion's main competition for ordinary Web-site building is Microsoft FrontPage, which is far faster and easier to work with but lacks Fusion's pixel-level graphics control. For graphics-rich Web sites without HTML coding, though, Fusion still surpasses all rivals.

NetObjects Fusion 4.0. Price: Windows $569, Mac $439. Requires: 32MB RAM, 50MB hard disk space, Microsoft Windows 95 or NT 4.0. Firmware-Design; Ph: 02 4721 7211; Fax: 02 4721 7215; www.firmware.com.au

DISPLAY: PHILIPS 107MB

On the Short Side

By Matthew Klare

Philips Monitors' new 107MB short-necked 17in monitor is no deeper than most 15in displays, yet offers 16 inches of viewable area. Its uses a Black Matrix dark glass Invar tube with a 0.22mm dot pitch and displays sharp, crisp images. Moreover, its $799 price isn't rough on your wallet.

Five small buttons on the 107MB's bezel are used to adjust the brightness and contrast, and to control the onscreen display (OSD). There's also a small power switch flanked by an indicator light, but due to its shallow depth, we found it too small and rounded to operate conveniently. On the other hand, if you use a surge suppressor to power your system, the monitor's switch becomes a moot point.

Philips' OSD is easy to master and convenient to use. It provides basic picture and geometry controls, including balanced pincushion and rotation, and colour temperatures of 9300 and 6500 degrees Kelvin. The OSD is also used to correct horizontal and vertical moiré, manually degauss the tube, specify the menu language, and change the length of time the menu will remain displayed. Finally, it displays the current resolution and scan-rate settings, with a toggle for the power-saving mode. Nevertheless, it lacks adjustments for convergence and linearity, which are commonly found on most expensive monitors.

You won't mind looking at the Philips 107MB, and it'll save you desk space.

All the OSD adjustments are duplicated through the included Philips CustoMax software, but you must connect the 107MB via its USB port to gain this enhancement. An audio pass-through on the monitor's base lets you connect the 107MB to your system's sound card. (You'll also find a headphone jack on the monitor's base.) Contrary to the instruction manual's claim, the 107MB lacks internal speakers.

The 107MB supports resolutions up to 1600 x 1280 at 65Hz. We tested it with a Matrox Millennium II graphics board at the more comfortable resolutions of 1024 x 768 at 85Hz and 1280 x 1024 at 75Hz. Performance testing was done using Sonera Technologies' DisplayMate 1.2. Screen uniformity, image geometry, and convergence were all quite good for a monitor in this price range. We were also impressed by the 107MB's high contrast and bright, sharply focused image.

Overall, the Philips 107MB affords ample provisions to correct the few image flaws we encountered. And although this monitor probably wouldn't be a first choice for graphics professionals, it works handsomely as a general-purpose monitor—and conserves desk space to boot.

Philips 107MB. Price: $799. Philips; Ph: 02 9805 4142; Fax: 02 9704 8483; www.philips.com.au

An incredible list of features, at a stunning new price, in a

full sized printer.

It can cut ink consumption by 75%, be used as a scanner, improve printed images down-loaded from the Internet, or even print banners. And this is in addition to better colour for plain paper, PhotoRealism inks for the gold standard in photo quality printing, plus super fast B&W!

Better operating economy. Super Economy mode reduces ink consumption by 75% compared to Standard mode, and works in both black and white and colour. It can print up to 3600 pages in black and white, and up to 400 in colour!

Better on plain paper. Another feature is Canon's Drop Modulation Technology with dual drop sizes for smoother colour gradations. It is designed to produce better looking colour on plain paper, which also helps keep operating costs down.

The PhotoRealism gold standard. When quality is most important, there is the option of Canon PhotoRealism inks. They vary the saturation per pixel so that a single dot could have 0%, 33%, 67% or 100%. This produces up to five times as many colour combinations as conventional CMYK inks, with better half-tones and almost no visible grain, even in areas of low colour density.

Super Economy in colour and B&W

High speed blacks. A high-speed black ink cartridge with 128 print nozzles is included with your purchase. It is capable of speeds up to 510 characters per second (4.5PPM).[2]

It's even a scanner. The optional IS-22 scan head allows you to turn your printer into a colour scanner in seconds. It scans colour images up to 360 dpi and offers high speed B&W scanning for fax, OCR and copying functions.[3]

Canon Customer Care. All Canon printers feature a one-year warranty, upgradeable to three years for minimal cost, and are backed by unlimited hot-line support.

The BJC™-4310SP. Everything you could ask for in a printer, and a little more. For more information call us on 1800 021 167.

Photo Realism™

BJC-4310SP colour Bubble Jet™ printer – $239[RRP]

Canon

Price shown is the recommended retail price including tax. Canon Australia Pty Ltd ACN 005 002 951. Canon and the Canon logo are registered trademarks and BJC, Bubble Jet, Drop Modulation Technology and PhotoRealism are trademarks of Canon Inc. All other trademarks are the property of their respective owners. 1. Output by cartridge may vary based on operating conditions. Super Economy page numbers are based on BC-20 black cartridge with 7.5% coverage and BC-21e colour cartridge with 5% coverage. Super Economy function not available with PhotoRealism inks. 2. Print speeds measured under DOS environment. 3. Fax, copy and OCR functions require user supplied software. Canon reserves the right to change specifications without notice.

CS6013

GRAPHICS: ADOBE IMAGE STYLER

No Design Degree Required

By Bonny L Georgia

You've got an eye for the bottom line, but no sense of design. So how do you painlessly make your Web site professional and beautiful? Try Adobe Systems' $295 ImageStyler.

Adobe ImageStyler isn't just about design; it's about saving time. No more saving each graphic for your Web site as a separate file that you later piece together with other graphics in a layout. ImageStyler lets you create all the graphics for your Web page at one time, which gives it a more cohesive overall look. As an added bonus, ImageStyler even creates the HTML necessary to get that design on the Web.

ImageStyler considers each element a discreet live object, whether it's a simple shape, a digital photo, or a block of text. Each object has styles—a mixture of colour, depth, opacity, distortion, and other effects applied with a simple click (and the occasional drag). Objects also have layers, which contain various styles. Turn these layers on or off for different views. For example, if you don't like a bevel, turn it off, and other layer effects such as glows and gradients are left in place. Also, for repeating elements like button backgrounds, it's no longer necessary to re-create each object from scratch. Simply make an alias of your first button, and changes cascade to all the other buttons.

ImageStyler's Active Preview feature shows what an image will look like when saved in JPG, GIF, PNG, or Photoshop format. To export individual objects within your workspace, just highlight one and choose Export Selection from the File menu. This is the only way to save objects as different image types. If you export the whole workspace, ImageStyler breaks up the component images where appropriate and makes an HTML file that holds them together in a table. This code isn't pretty, and HTML purists will sniff at it, but it does the job.

INTERFACE CREATOR *Design your own Web graphics painlessly with Adobe Systems' $295 ImageStyler. Even add rollovers and links—they're ready to run in your browser of choice.*

JavaScript rollovers on images help visitors to your site know what to click on. But making them hasn't always been easy, even in programs like Macromedia Fireworks that support this feature. ImageStyler, however, devotes an entire palette to JavaScript rollovers. It's a cinch to offset a graphic by a few pixels, or change its size, shape, text, or style when a cursor passes over or clicks on the image. By the same token, creating client-side image maps in ImageStyler requires only associating a URL with an object—then it's ready for output. Rollovers with no URL associated, though, end up going to www.adobe.com.

GET IN SHAPE: *Select from any of the numerous shapes included in ImageStyler to create an object, or use any shape as a matte over your image.*

Anyone familiar with Adobe's other Web tool, the $295 ImageReady, will recognise that it and ImageStyler are two sides of the same coin, with individual strengths and weaknesses.

With ImageReady, Adobe has entered the red-hot market for easy-to-use Web graphics tools. Competitors include NetStudio 1.0, a graphics editor that taps the Microsoft Office crowd with quick-and-easy Web graphics. Also worth a look is JASC Software's Paint Shop Pro 5, a complete imaging suite that includes animation tools.

In the future, Adobe should just combine ImageStyler and ImageReady into a single easy-to-use image creation tool for the Web—even the names are too similar. Until then, the cheaper and easier-to-use ImageStyler is the better way to go. But if you can get both programs, you're that much closer to Web graphics nirvana.

Of course, the serious graphics professional should stick with Adobe Photoshop and Illustrator for their more powerful image-editing features (and steeper learning curves). Also check out Macromedia's Director 7.0 Shockwave Internet Studio, a complete suite of multimedia tools.

ImageStyler. Price $295. Adobe Systems; Ph: 1800 065 628; Fax: 02 9418 8489; www pacific.adobe.com

Canon BJC-80
$399RRP

Canon BJC-50
$699RRP

PORTABLE
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Advanced colour, cable-less communications, optional scanner plus two sizes that are

Small and smaller!

Canon has a wonderfully new idea for people that need a portable printer. A choice.

On the small side there is the BJC™-80. It is a fraction of the size of a briefcase. Yet, with its in-built sheet feeder and power adaptor included as standard, it is designed for people who have to produce high volume output from a very small printer.

Drop Modulation Technology.

Conversely, if size is critical, there is the brand new BJC-50 with in-built battery. It's not just small, at approximately half the size of the BJC-80 it's absolutely tiny.

Equally impressive, their performance is as big as their size is small.

Using Canon's advanced Drop Modulation Technology™ you can print everything from colour charts, to high quality photographs. Or, in seconds you can convert to extra high-speed black and white for finished business documents using the dedicated black cartridge with 128 print nozzles! For greater portability, both models include an infra-red port for totally cable-less communications with any suitably equipped Windows® 95/98 notebook or PC.

The BJC-80 fits in approximately half the space of a briefcase. The BJ-50 is approaching 50% smaller still.

Optional colour scanner.

And, if you really need the functionality of an office in the space of a briefcase, both models will accept an optional colour scanner head in place of the print head. It takes only seconds to change the heads. You can then use the scanner head to acquire colour images, or for fax and OCR functions.*

Cable-less communication.

Canon Customer Care. All Canon printers feature a one-year warranty, upgradeable to three years for minimal cost, and are backed by Customer Care hot-line support. Drivers are available for DOS, Windows 3.1x/95/98 and Windows NT.

If you need help choosing between small, and smaller, give us a call on 1 800 021 167.

Canon portable colour Bubble Jet™ printers

Canon

Prices shown are recommended retail prices including tax. *Scanner-head works with Windows 95/98 only. Fax and OCR software not included with purchase. Canon and the Canon logo are registered trademarks and Drop Modulation Technology, Bubble Jet and BJC are trademarks of Canon Inc. Windows is a trademark of Microsoft Corp. in the U.S. and other countries. Canon Australia Pty Ltd ACN 005 002 951. CS6019

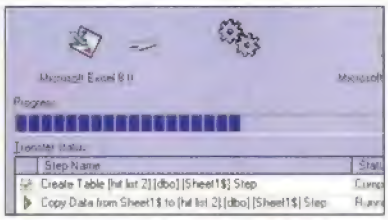
DATABASES: MICROSOFT SQL SERVER 7.0

Find and Sort All Your Info-Fast

By Micheal Gardner

Maybe you and your startup company need something more sophisticated than business cards pinned to a bulletin board to keep track of key contacts. Or maybe you're tired of accidentally buying duplicates of your souvenir-spoons-of-the-world collection and you need to organise an inventory list. Either way, Microsoft wants to help with a new version of their database products.

Microsoft has made some ambitious advances in scaling down SQL Server 7.0 for personal use. For the first time, SQL Server can run on a single Windows 95, 98, or NT workstation, using a separate installation called the Desktop Edition. The Microsoft Database Engine powers both this edition and the upcoming Microsoft Office 2000 suite, although Office 2000 will not have the same administrative tools.



NO GEARS GRINDING: *You'll find wizards for almost any task in SQL Server 7.0, including importing data.*

The resulting product is a beast with features and data-warehousing capabilities you may never fully explore. If you're not a database specialist, you'll spend considerable time fumbling through management and analysis tools trying to complete simple tasks. But if you ignore your instincts and use the many wizards Microsoft has added, you can get the hang of things fairly quickly.

SQL Server 7.0 takes the Explorer-style interface to a new level, even using the plus and minus signs to hide items for simple menu choices—an annoying extension of the scheme. Wizards guide you through every step. Unfortunately, they sometimes walk you toward features not applicable or available in the hobbled Desktop Edition.

Microsoft clearly has no intention of really using SQL Server to compete in the desktop database environment; after all, that's Access territory. The goal of offering this scaled-down option is compatibility, running databases on servers, workstations, and even notebooks.

The new scalability applies to everything except the price: even if you want only the Desktop Edition, you pay for the whole enchilada. The good news about price is that it hasn't changed from version 6.5. For heavy-traffic, multiuser environments, SQL Server 7.0's strides in ease of use and scalability make an industry standard even better.

SQL Server 7.0. Price: 5 Client $2319. Microsoft. Ph: 13 20 58; Fax: 02 9805 1108; www.microsoft.com.au

INPUT: GENIUS SYSTEMS NEWSCROLL MOUSE

Let the Good Times Scroll

By Peita Duggan

The NewScroll mouse by Genius Systems makes pointing and clicking a whole lot simpler. With its unique "Magic Surfer" control, positioned in between the left and right buttons, it lets you scroll Web sites and documents with ease.

The NewScroll's design does not stray from the usual mouse design and is almost the exact same shape as the Microsoft IntelliMouse. Where it differs is the oval shaped protuberance that sits on a wheel between the buttons. The NewScroll also features a side button that is operated by the thumb.

The NewScroll can be connected via either the PS/2 or serial port and software installation is easy, just insert the disk and follow the prompts. Once this is done you can customise the mouse's settings to your own requirements. Some of the features you'll find include Auto-Browsing and Looping.

Auto-Browsing scrolls automatically when you hold down the Magic Surfer for a few seconds, this is especially handy for long documents and when searching for files in large folders.

Looping allows the mouse to continue on its path instead of stopping at the edges of the screen. Push your cursor to the top of the screen and it disappears only to reappear at the bottom of your screen.

A side click will open the NewScroll's EasyJump for Windows menu, which can activate eight functions, this, as the name suggests, makes working in Windows easier. The functions it performs include opening the Start and Help menu's, opening the Control Panel and an Internet browser, Auto-Panning and closing the application in use. The Open Internet browser function can be changed to Add Favourites (IE), Organise Favourites (IE), Add Bookmark (Netscape), Edit Bookmark (Netscape), Go Next (Forward) and Go Previous (Back).

Genius Systems claim that the NewScroll can "eliminate 30 percent of your mouse movements", so if you are looking for a product which is almost effortless to use and makes Web surfing a breeze, then this may be for you.

Genius Systems NewScroll. Price: $39 ($34 with trade in). BBF Components & Peripherals; Ph: 03 9761 4299; Fax: 03 9761 4001; www.bbf.com.au

Only Canon offers a way to acquire and print images in colour with a

printer and scanner in one!

Canon has a unique solution to a question that has often plagued colour printer users. How do you get the image in, so you can output it to your Canon colour Bubble Jet™ printer?

Only from Canon. It is an optional scanner head that fits right into your printer, and it is available on several models for just $149.RRP

It takes only seconds to replace the print head with the scanner head. This then allows you to acquire images for storage, editing, manipulation, placement on the Internet, or even OCR and faxing, with the right software.

Easy to use. To get you started, Canon includes image acquisition and editing software with your scanner head purchase at no extra cost! And using it, you can scan full colour or 256 grey-scale images in resolution up to 360 dpi. Or you can use high-speed mode if you simply want Black and White at 90 dpi, supported by most fax software.

Best of all, Canon offers a full range of models with this remarkable functionality. They are the BJC™-50 and BJC-80 portable printers, the BJC-4310SP and BJC-4650!

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Canon Customer Care.
All Canon printers feature a one-year warranty, upgradeable to three years for minimal cost, and are backed by Customer Care hot-line support. Printer drivers are available for DOS, Windows® 3.1x/95/98 and Windows NT.

If you would like to learn more about how to get your printer to input as well as output, call us on 1 800 021 167.

The BJC-4310SP with PhotoRealism.

The portable BJC-80.

The even smaller, portable BJC-50.

The BJC-4650 for Windows and Macintosh and sizes to A3.*

Optional scanhead – just $149RRP

Canon

Price shown is the recommended retail price including tax. 1. Compatible with Windows 95/98 only. Canon and the Canon logo are registered trademarks and Bubble Jet and BJC are trademarks of Canon Inc. Windows is a trademark of Microsoft Corp. in the U.S. and other countries. Canon Australia Pty Ltd ACN 005 002 951. CS6020

NETWORK MANAGEMENT: OPTIMIZER V 2.0

Ending Net Bottlenecks

By Robert P. Lipschutz

Does your small or medium-size network suffer from slow Internet access? Now you can diagnose and, in some cases, correct this problem with Elron Software's Elron Bandwidth Optimizer v2.0 (starting at $6999 for 25 users). The product documentation outlines a smart approach: First understand network traffic, then act to improve it.

Bandwidth Optimizer sits at the periphery of your network and provides a view of Internet usage with a variety of reports and charts. In turn, you use this information to prioritise and shape the traffic that travels in and out of your network.

Unlike highway automobile traffic, network traffic can be elusive and difficult to see. To help you better understand your network traffic, Bandwidth Optimizer gathers packets travelling to and from the Internet and creates reports and charts based on what it sees. We created useful charts and reports based on top users and type of service (HTTP or RealVideo, for instance) over time and in real-time. Bandwidth Optimizer's charts and reports made spotting traffic patterns that were causing network congestion easy.

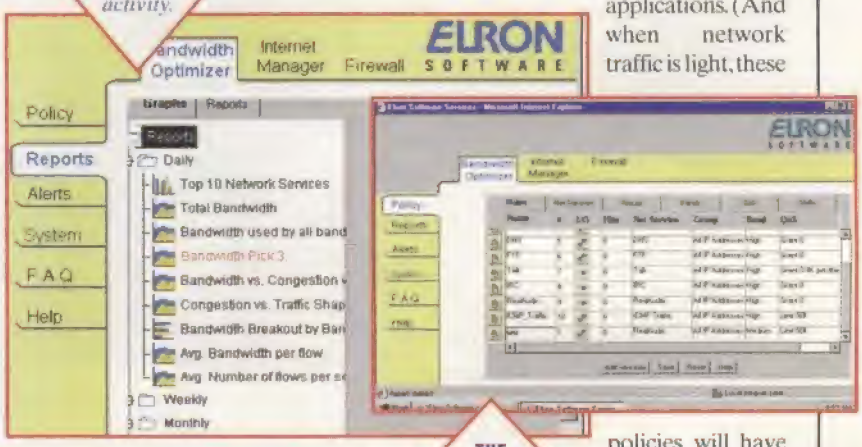
Once you "see" your network and can spot patterns, you can create a network bandwidth-management policy consisting of a set of prioritised bandwidth rules, and that will, in turn, shape future network traffic. The rules match combinations of users and groups, designated by IP addresses, and service types like HTTP, with a designated band of your available bandwidth. Further honing can be done by assigning a specific quality of service to a particular bandwidth rule and indicating specific minimum and maximum flows. The result is that when network traffic is light, all users and services get the bandwidth they want, but when congestion occurs, the bandwidth rules are used, allowing higher priority traffic through and slowing or stopping lower-priority traffic.

The product doesn't integrate with common user databases such as Novell NDS or a Windows NT domain, so when monitoring or shaping policy, users can be identified only by their IP addresses. For those networks that use Dynamic Host Control Protocol (DHCP), administrators will have the extra headache of matching up users with their current dynamically assigned addresses.

Developing a traffic policy with Bandwith Optimizer has three primary uses. First, it's useful for those networks that need to segregate "good" versus "bad" traffic, meaning for instance, networks that have business communications and Quake tournaments running simultaneously. Second, for those small and medium-size companies that are hosting their own Web site or mail server, Bandwidth Optimizer can be used to prioritise incoming-versus-outgoing traffic. Finally, if you're prepared to put some time into analysing your traffic patterns, some of you might find joy in freeing up a few kilobits of bandwidth for individual users or applications. This can be especially useful for those connecting to the Internet through dial-up, low-bandwidth circuits such as analogue, or ISDN lines.

Elron suggests Bandwidth Optimizer run on a dedicated Windows NT machine with two NICs if you wish to do both monitoring and traffic shaping (it's certified with the 3Com 3C509 and 3C905 models). You deploy the product between your network and Internet router, but inside your firewall or proxy server if you have either of these.

KEEPING TRACK: *Flexible daily, weekly, month, and yearly reports show short- and long-term activity.*



THE RULES RULE: *Bandwidth rules are the key to shaping traffic; here, a rule to limit RealAudio traffic is highlighted.*

For management, you can use Microsoft IE 4.01 or Netscape Communicator 4.5 or later. A browser-based interface typically means easy remote management, but the large Java applet used for configuration makes management over slow links tedious. The company suggests that you also change your browser's cache settings to reload pages every time, so the Java applet will always show the latest configuration information.

The challenge of this product is that it gives administrators the knowledge to shape the traffic flow, but improvement of traffic flow can't be guaranteed. In addition, the lack of integration with common user databases such as Novell NDS trees or Windows NT domains leaves the network administrator with only the TCP/IP addresses to distinguish users and groups on the network.

Another concern is that creating policies about bandwidth usage can take a lot of time and is sure to be controversial. Administrators will have to consider carefully what the impact will be on low-priority users and applications. (And when network traffic is light, these policies will have no effect, as everyone gets all the necessary bandwidth each one needs.)

If your users are experiencing network and Internet access delays and a faster connection is somehow out of reach, Bandwidth Optimizer will give you vision and control over your network bandwidth.

Elron Bandwidth Optimizer v2.0. Price: For 25 users, $6999; for 50 users, $7999; for 100 users, $9999; for 255 users $11999; for 500 users, $16999 for 1000 users, $25,999. Choice Connections. Ph: 02 9951 7979; Fax: 02 9957 4325; www.elronsoftware.com

COUNTDOWN 98

The Editor's Choice

- Beyond -

"Not only was it the fastest system overall, but it is well rounded and would cope well in both a business and a home environment. ..... so get one while they last."

Editor - PC Magazine October 1998

"Taking out the Labs Value Award for this month's Internet PC comparison, the Velocity not only represents excellent value for money, but claims the title of the fastest Celeron-powered PC we've tested to date. . .Considering the outstanding performance and top notch peripherals that fill the system, the Beyond should comfortably satisfy the most demanding users. The fact that you get all this for under $2,500 makes the Velocity unparalleled in this Labs in terms of value for money."

Editor - PCAUTHORITY, April 1999

"As with previous systems offered by Beyond Computers we found its Ultimate Games entrant a great performer. In fact the performance of this system was so good it took top honours in the speed stakes and second place in the Bang for Buck calculations. This was all that was needed to award it the Editor's Choice for this review."

Editor - PC Magazine December 1998

SuperO Professional

SuperO 250W Midi Tower ATX model
3.2GB Quantum Ultra ATA HDD
8MB AGP 3D Video ATI Range IIC Chipset
15" NEC V500 MultiSync Digital Monitor
104 Ergonomic Keyboard PS/2
PS/2 Mouse Logitech
40X IDE CD ROM & 3.5" Floppy
Microsoft Windows 98 and IE 4.0
Anti Virus Protection

Intel Celeron A 333 CPU
32MB SDRAM PC100 — $1510

Intel Pentium II 350 CPU
64MB SDRAM PC100 — $1840

SuperO Speedo

SuperO 250W Midi Tower ATX model
8MB AGP Video Matrox Millennium G200
15" Sony Trinitron Digital Monitor 0.25
6.4GB Quantum Fireball Ultra DMA HDD
104 Ergonomic Keyboard PS/2
PS/2 Mouse Logitech
40X IDE CD ROM & 3.5" Floppy
Microsoft Windows 98 and IE 4.0
Anti Virus Protection

Intel Celeron A 366MHz CPU
32MB SDRAM PC100 — $1920

Intel Pentium II 400MHz CPU
64MB SDRAM PC100 — $2450

SuperO Velocity

SuperO 250W Midi Tower ATX model
16MB AGP Video Leadtek WinFast S320
(Based on Riva 128TNT with TV/Out)
17" LG Digital Monitor 80Hz
6.4GB Quantum Fireball Ultra DMA HDD
Creative Sound Blaster LIVE PCI Audio
120W HiFi Speakers (AC Power)
104 Ergonomic Keyboard PS/2
PS/2 Mouse Logitech
40X IDE CD ROM & 3.5" Floppy
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Anti Virus Protection

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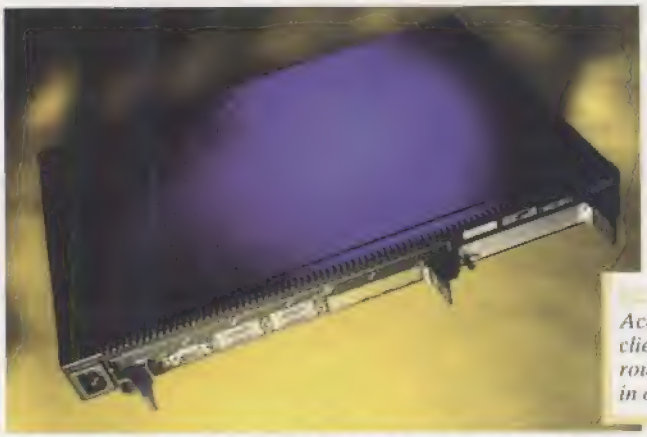


The new IBM 2212 Access Utilities incorporate thin client, VPN, load balancing, and routing capabilities (and more) in one chassis.

NETWORKING: IBM 2212 ACESS UTILITY 10H

Branch Office in a Box

By Steve Rigney

By the time you install all the necessary thin client, remote access, Virtual Private Networking, routing, load balancing, and encryption hardware in all of your branch offices, you are probably out of both money and space. IBM may have a solution to your problem in the form of the IBM 2212 Access Utility 10H ($8948 list for base unit). The 10H incorporates all of the branch office functions listed above into a single chassis.

There are actually two new 2212 Access Utilities to choose from: the 10H and the 10F. Both include four WAN ports for routing, a built-in serial port, and two available slots for adding options, such as an Ethernet or Token-Ring adaptor and a BRI or PRI ISDN adaptor. The major difference between the two models is that the 10H contains a 3.5GB hard disk compared with a 48MB Flash ROM for the 10F. With the addition of the hard disk, the 10H is able to perform more functions than the 10F, including the abilities to act as a thin client server, load-balancing device, and TN3270E terminal-emulation server. Both units come housed in a 19-inch rack-mountable chassis, and each costs $8948. We chose to look at the 10H because of the added functionality for the same price.

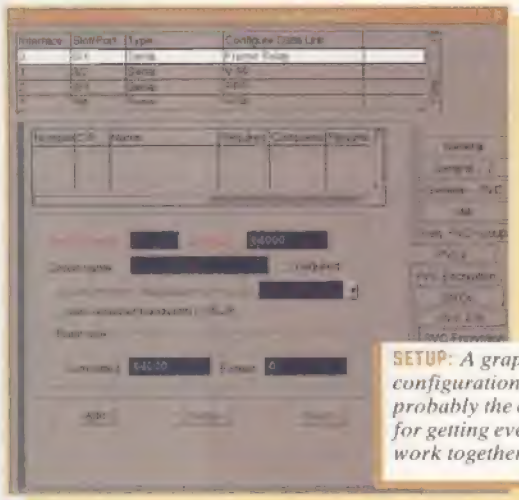
The 10H performs many functions, so it is necessarily complicated to set up and configure. You have a choice of either a graphical Windows configuration utility or a terminal-emulation program via a serial connection to initialize and configure the unit. After a couple hours of trial and error with both types of configuration, we were able to make the 10H performas intended.

A third option is remote configuration using a dial-in modem attached to the unit's serial port. This is important for any branch office solution.

The remote access and VPN capabilities are the most useful of the 10H's many features. Remote access is available using the optional Dial-In Access to LANs (DIALS) feature. DIALS works with internal ISDN adapters to allow remote users to dial into the LAN and local users to dial-out across the LAN to other services, such as the Internet. Other DIALS features include usage tracking and effective security settings. For now, remote access only works with ISDN connections, but IBM plans to ship an analogue modem adaptor by June.

The 10H offers all of the VPN functions you need including authentication, encryption, and tunnelling. Authentication is available in the form of the IP Security (IPSec) protocol and a built-in authentication, authorization, and accounting (AAA) server. Encryption is available in software using IPSec but is faster and more effective using an optional Compression Compact PCI adaptor. This adaptor performs hardware encryption and compression to increase performance. Tunnelling is available using both the IPSec standard and the Layer 2 Tunnelling Protocol, both of which are built into the 10H's software. The IPSec protocol is more secure than L2TP, but L2TP lets you tunnel other protocols besides IP, such as IP or AppleTalk. We find that the 10H's combined solution is best.

The thin server functions in the 10H are useful only if you have Network Stations (NSs) attached to your LAN. Normally NSs connect to a host, such as an AS/400 or other midrange system, in order to boot-up and function on the network. If dozens of NSs attach to the host at once, system performance can slow down. Likewise, if the host is situated at another location, expensive long-distance connections may be necessary to connect NSs located at branch offices. The 10H can work as a surrogate host to let the NSs boot up and access files and applications. You'll still need a connection to the application servers, but the thin server utility can cut down on remote traffic and the load on the host computer.



SETUP: *A graphical Windows configuration utility is probably the easiest option for getting everything to work together as intended.*

The built-in WAN ports allowed us to set up the 10H to server as either a bridge or a router between different LAN segments. The 10H works with multiple protocols including AppleTalk, Banyan Vines, DECnet, IPX, NetBIOS, and TCP/IP. Because the 10H is an IBM solution, it also provides support for SNA connections to a centralised host mainframe.

IBM 2212 Access Utility 10H. Price: For base unit, $8948. IBM Australia. Ph: 13 24 26 ; Fax: 02 9354 7766 ; www.ibm.com.au

Did evolution pass your monitor by?

The Hyundai theory of natural selection says that most computer users have a decent computer and graphics card, but their bundled monitor is a holdover from some prehistoric age with a screen as curved as dinosaur's eye. Or footprint so large, it makes their desktop space extinct.

Fortunately, evolution has produced a worthy successor. The Hyundai DeluxScan P990. A new species of 19-inch monitor that Darwin would approve of. The P990's reduced-depth CRT conserves valuable desktop space, while its 18-inch viewable image and 1600X1200 resolution at a flicker-free 75 Hz refresh rate open up a new world of workspace for greater productivity. The P990 delivers images 25 percent sharper than its predecessor due to dynamic focusing circuitry for ultra-sharp focus from edge to edge, and its crystal pigment coated phosphor for superior contrast and brightness. It's also TCO-99 certified to ensure the user and the environment a long, uneventful existence long past the 3-year limited warranty.

Hyundai DeluxScan P990 is a welcome evolution for the information age desktop. And the perfect way to get more workspace in every way.

DELUXSCAN®

	Conventional				Reduced - Depth		
	S570	S770	B790	P910	7770 Dream	B790S	P990
CRT	15-inch	17-inch	17-inch High-Contrast	19-inch High-Contrast	17-inch Short-Neck	17-inch Short-Neck	19-inch Short-Neck
Viewable Area	13.7-inch	16-inch	15.7-inch	18-inch	15.7-inch	15.7-inch	18-inch
Dot Pitch	.28 mm	.27 mm	.26 mm	.28 mm	.27 mm	.26 mm	.25 mm
Horiz. Frequency	30 - 70 kHz	30 - 70 kHz	30 - 95 kHz	30 - 107 kHz	30 - 70 kHz	30 - 95 kHz	30 - 95 kHz
Max. Resolution	1280 X 1024	1280 X 1024	1600 X 1200	1792 X 1344	1280 X 1024	1600 X 1200	1600 X 1200
TCO option	TCO 99	TCO 99	TCO 99	TCO 99	TCO 99	TCO 99	TCO 99

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DEVELOPMENT: MICROSOFT BACKOFFICE SBS 4.5

Network Treasure Chest

By Les Freed

Microsoft is marketing BackOffice Small Business Server 4.5 (SBS) as a software bundle that provides virtually everything that a small business needs to get started in networking. The package (currently in beta; price to be announced) lives up to this marketing hype by including a smorgasbord of Microsoft products, including Exchange Server 5.5, Fax Service 4.5, FrontPage 98, Internet Explorer 5.0, Modem Sharing Service 4.5, Outlook 2000, Proxy Server 2.0, SQL Server 7.0, Windows NT Server 4.0, and in one of the two versions, Microsoft Office 2000 Professional. We tested a public prerelease of Version 4.5 with Office 2000; Microsoft claims the final release version will be available no later than the second quarter of this year.

The entire SBS package installs at one time using a new wizard-based setup engine. The installer provides modem installation and hardware detection options that aren't available in the standalone Windows NT Server installer, and it allows you to spread the 3GB of installation files across several hard disks if necessary. Despite the simplified setup engine and the small business focus of the package, Microsoft estimates that about 90 percent of all SBS installations are still performed by a VAR or technology consultant, usually as part of a new PC or small network solution purchase.

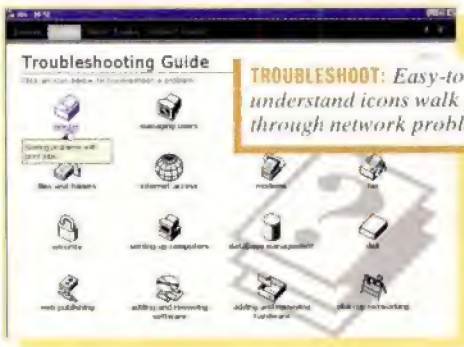
It's important to note that SBS must be installed as a "clean install" on your server PC: the SBS server must be the Primary Domain Controller (PDC) on your LAN, and the install will fail if another PDC exists on the network. SBS creates its own private IP network addresses, and the SBS client PC installer uses those addresses to communicate with the client PCs. Installation of the full package—including Office 2000—takes about four hours, even on a fast server.

Also note that SBS uses Windows NT Domain Security, so all users and client PCs must have an account on the server. This will be a major change for those who have been using Windows 95's File and Print sharing services.

SBS provides users with easy access to system administration and maintenance via the SBS Console program. The SBS Console lets users manage user accounts and passwords, client PCs, and shared resources (files, printers, and access to the Internet and fax sharing services) via a simple browser-based interface. The SBS Console also serves as an early warning system, displaying a bright red bar with descriptive error messages when some part of the system isn't working properly.

Each PC must be configured to work with the SBS server before it can communicate on the LAN. When you use the SBS Console to create new PC accounts on the SBS server, it creates a floppy disk containing a setup program and configuration files for each PC on your LAN. To set up the client PCs, you boot the client PC and then run the setup program from the floppy disk. The Client installer renames your existing PCs and modifies the network settings to use the SBS server as the IP gateway, Proxy Server, and DHCP server for the entire LAN.

Once you've configured your client PCs, you use the same SBS Console to create user accounts on the server. As part of the user-creation process, you tell the SBS Console which PCs each user can use, and which applications each user needs to use. When that user logs in from a client PC, SBS checks to make sure the specified applications are installed on that PC and will install them if necessary. Depending on the options you select, each client PC will require at least one reboot. SBS supports Windows 95, Windows 98, and Windows NT Workstation (but not Windows NT Server) 4.0 clients.



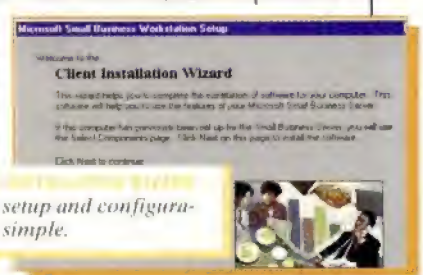
TROUBLESHOOT: *Easy-to-understand icons walk you through network problems.*

SBS provides shared Internet access via Microsoft Proxy Server 2.0, letting you share a modem, ISDN, cable modem, or DSL connection over the LAN. We tested Proxy Server with both a 56K modem and a cable modem connection; both worked flawlessly.

SBS also includes Microsoft Exchange Server, which can handle incoming and outgoing Internet mail, but this feature works best if you have your own Internet domain name. Small businesses may find it simpler to purchase multiple POP mailboxes from their ISP. The Outlook 2000 mail client works with Exchange or public POP mail servers, so you can start with POP mail and move up to Exchange-based mail as your needs dictate.

The Microsoft Fax Sharing service provides basic outbound fax transmission via a shared modem. All incoming faxes can be routed to a specific LAN printer or to a specific Exchange mailbox, but SBS doesn't provide inbound fax routing as do dedicated LAN fax programs. It's possible to use one modem for both Proxy Server and Fax Sharing, but heavy fax users will likely need a second modem and a dedicated fax line.

Microsoft hadn't announced final pricing for SBS as we went to press, but we expect the price to be similar to that of SBS 4.0. At $2479 for 5 workstations, SBS 4.0 provides a full suite of LAN-based services at a reasonable price, and the new version does the same. Microsoft's Preview program lets prospective users try the software for 120 days at minimal cost, but be aware that the preview version can not be upgraded to the final release of SBS; you'll have to sit through that four hour installation all over again.



Client setup and configuration is simple.

Microsoft BackOffice Small Business Server 4.5 (beta). List price: TBA (free upgrade for existing SBS 4.0 users.). Microsoft Australia. Ph: 13 20 58; Fax: 02 9805 1108; www.microsoft.com.au

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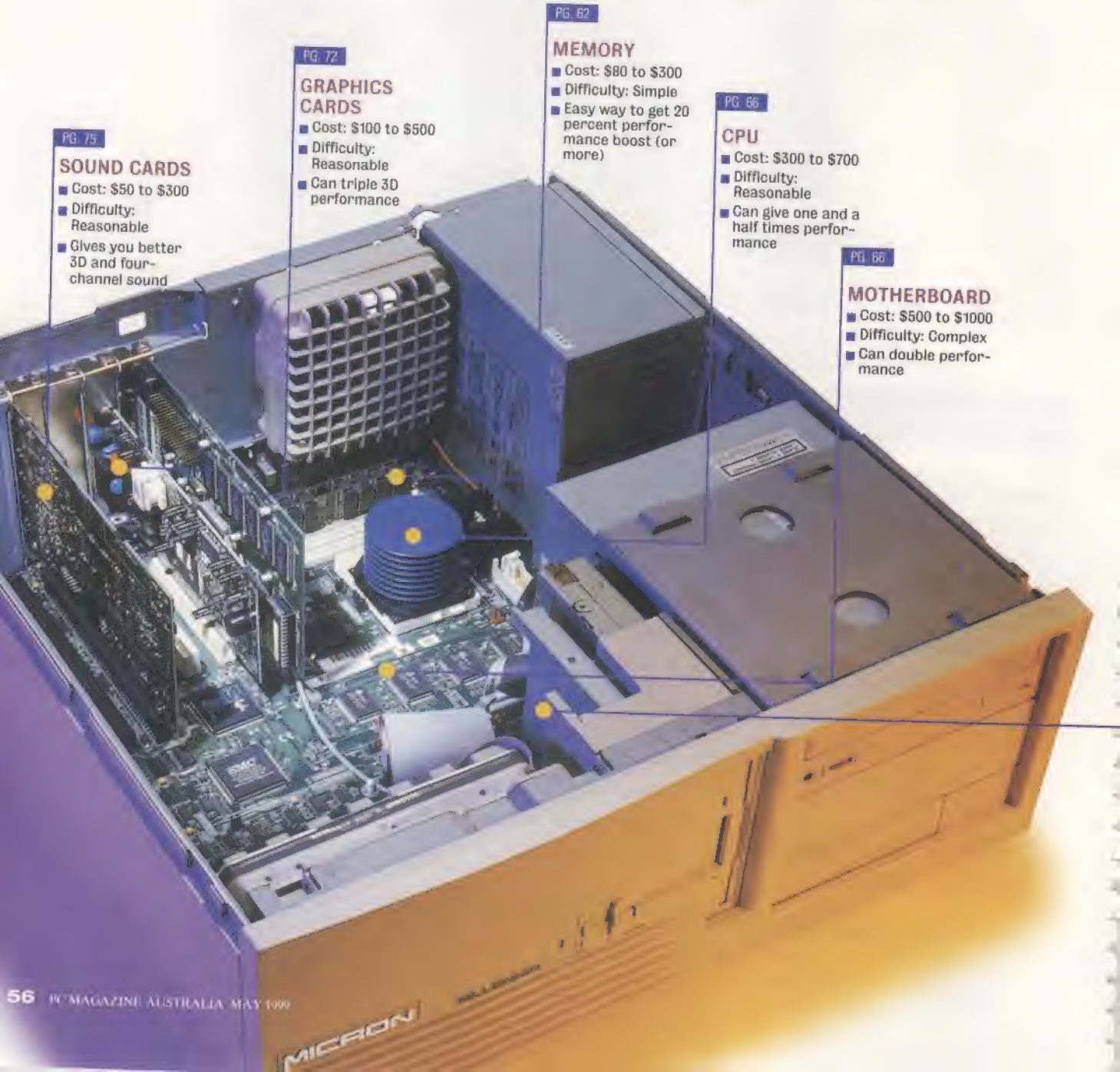
The Ultimate Upgrade Guide



PG. 74

MONITORS

- Cost: $800 to $3000
- Difficulty: Simple
- Larger viewing area, or better, brighter picture with LCD

PG. 76

SPEAKERS

- Cost: $150 to $900
- Difficulty: Simple
- Enhance listening experience with four-channel sound and subwoofers

HARD DISKS

- Cost: $300 to $900
- Difficulty: Reasonable
- Triple storage capacity (or better) and get 10 percent overall performance boost

Should you upgrade some parts of your old system or buy new? That's the question many of us are facing today. In "The Most Cost-Effective Upgrades," the first section of our Ultimate Upgrade Guide, PC Magazine Labs tests memory, processor, motherboard, graphics, and hard disk upgrades and compares them with three new systems to see which—if any—upgrades are worth your time and money. In the section that follows, we test and review over 55 components—including multiple motherboards, DVD drives, sound cards, and more—to find the best products for your upgrade needs.

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- Upgrade Test Results 62, 64

THE MOST COST-EFFECTIVE UPGRADES

By Alfred Poor

Who among us hasn't looked upon shiny new systems with longing, then turned back to work on a computer that is more than a few generations behind the leading edge? For a modest investment, you can breathe new life into your existing system, avoid the hassles of converting to a new computer, and extend your original investment a few more years.

Sounds great, right? But the big question is which upgrades are worth the money, especially considering that new PC prices are as low as $1500 to $2000.

To answer this question, you must examine the components in your existing system, the applications you use most often, and your budget. You should also consider how much technical support you need and the value of your time. Each upgrade takes anywhere from 15 minutes to one hour, and you may have to spend even more time troubleshooting the new part. There is satisfaction to be gained from doing the job yourself, and you will learn a lot in the process, but it will cost you.

To help you decide which upgrades make sense for your needs, PC Labs took two older systems—one 200MHz Pentium system and one 233MHz Pentium II—and performed a variety of hardware upgrades on each of them. We then ran our suite of benchmark tests on several upgrade combinations, comparing the results with the original system and evaluating the time and money spent for each upgrade. We also compared these upgrades with the price and performance of three new systems, one each from Compaq, IBM, and Gateway, to see when it makes sense to upgrade and when it makes sense to buy a new system.

WHEN DOES IT PAY OFF?

We found that if you're starting with a Pentium/200 system, you can breathe new life into your PC without spending much more than $1500, and often much less than that. A memory upgrade is still the most effective way to increase your general performance, and it will cost you around $100. The least expensive new PCs—those at about $1500—offer only minimal performance gains; their hardware is often only little better than our Pentium/200.

The new systems in the $2000 range offer about 35 to 40 percent better performance than our Pentium/200 system. But that's not all: you get a new warranty covering all parts, a single point of contact in case of trouble, generally better hardware, and (often) new software. Spend $3650 on a

Upgrade Your Pentium/200 Base System

Don't despair: For $1000 to $2000, you can still do a lot with your Pentium system. Try a memory upgrade first for $100.

$250 OR LESS

IMPROVE PERFORMANCE

Upgrade memory to 64MB ($100).

ENHANCE MULTIMEDIA

Upgrade memory to 64MB ($100).

IMPROVE 3D

Not feasible at this price.

INCREASE STORAGE

Add a 100MB Iomega Zip Drive ($250) or a SuperDisk LS-120 drive ($240).

$500 OR LESS

IMPROVE PERFORMANCE

Upgrade memory to 64MB ($100) or 128MB ($400).

ENHANCE MULTIMEDIA

Buy a new sound card and a new graphics card ($400), or consider a DVD upgrade kit ($500).

IMPROVE 3D

Buy a new graphics card with 3D support and 16MB of RAM ($300).

INCREASE STORAGE

Add a 250MB Zip Drive ($390), or a fast, 6.5GB hard disk ($450).

$1000 OR LESS

IMPROVE PERFORMANCE

Upgrade the CPU to an AMD K6-2/400, and upgrade memory to 64MB ($600).

ENHANCE MULTIMEDIA

Buy a 17-inch monitor, a new sound card, and speakers ($800), or consider a DVD upgrade kit, a new sound card, and speakers ($750).

IMPROVE 3D

Upgrade the CPU to an AMD K6-2/400, increase memory to 64MB, and buy a new graphics card ($750), or consider a 17-inch monitor ($650).

INCREASE STORAGE

Add a 5,400rpm 9.1GB hard disk ($800) or 7200-rpm 9.1GB hard disk ($1000), or consider a 2GB Jaz Drive ($750) or a CD-RW drive ($650).

$2000 OR LESS

IMPROVE PERFORMANCE

Upgrade to a Pentium II/400 motherboard (with 128MB RAM, $1300; with 64MB RAM, a new graphics card, and a 6.5GB hard disk, $1750), or buy a new Pentium II, Celeron, or AMD K6-2 system.

ENHANCE MULTIMEDIA

Buy a new Pentium II, Celeron, or AMD K6-2 system.

IMPROVE 3D

Buy a new Pentium II, Celeron, or AMD K6-2 system.

INCREASE STORAGE

Consider both a 10GB hard disk and a 2GB Jaz Drive ($1300), or buy a new Pentium II, Celeron, or AMD K6-2 system.

Pentium II/400 system with 128MB of RAM, a 12GB hard disk, and an 8MB graphics card and you'll get almost double the performance.

on an upgrade, read the product reviews in the following sections: Core Components, Multimedia, and Internet I/O.

A memory upgrade is still the most effective way to increase your general performance, and it's inexpensive—costing around $100.

If you have at least a Pentium II/233 PC, consider only targeted upgrades. Faster Internet connections or better 3D graphics performance can be had for under $400. Here, the new PCs in the $2000 range offer few performance benefits, but a new Pentium II/400 system—at $3600—offers about 55 percent better performance.

Some upgrades have nothing to do with quantifiable performance. You may be looking for better viewing quality from your monitor, a bigger monitor, or a larger hard disk. Or you may want a DVD-ROM drive so that you can enjoy the latest games, movie, and edutainment. Once you decide

OUR PLATFORMS

We started with two fairly typical systems: a Pentium/200 and a Pentium II/233 with 3D graphics support. We relied on the ZD Winstone benchmark test suite to gauge general performance on business applications and used the WinBench 99 tests to look at gains in specific subsystems. In addition, we used the new CPUmark 99 test to evaluate CPU and memory subsystem performance.

We then tested the performance with certain upgrade components installed both separately and in combination. We added memory, larger and faster hard disks, fast 3D graphics adaptors, and (for the Pentium/200) a new, faster CPU. We even replaced the entire motherboard and processor to turn the Pentium/200 system into a fire-breathing Pentium II/400 PC.

Now, you can't reduce these results to simple numbers, because in some cases there are advantages beyond just the performance increase. But we did perform a calculation that lets you compare the results on a quantitative level. We divided the percentage of performance improvement by the dollar cost of the upgrade used to get those gains. Again, for a Pentium/200, the single most cost-effective upgrade you can

Upgrade Your Pentium II Base System

If you have a Pentium II, even a low-end model, don't bother with bargain-priced PCs. Either save your money for a new system next year, or invest in some targeted upgrades of $1000 or less.

$250 OR LESS

IMPROVE PERFORMANCE

Upgrade memory to 128MB ($200)

ENHANCE MULTIMEDIA

Buy a new sound card ($200).

IMPROVE 3D

Not feasible at this price.

INCREASE STORAGE

Add a 100MB Iomega Zip Drive ($250) or a SuperDisk LS-120 drive ($240).

$500 OR LESS

IMPROVE PERFORMANCE

Upgrade memory to 128MB ($200).

ENHANCE MULTIMEDIA

Buy a new sound card and a new graphics card ($400), or consider a DVD upgrade kit ($500).

IMPROVE 3D

Buy a new graphics card with 3D support and 16MB of RAM ($300).

INCREASE STORAGE

Add a 250MB Zip Drive ($390) or a fast 6.5GB hard disk ($450).

$1000 OR LESS

IMPROVE PERFORMANCE

Upgrade memory to 128MB, add a fast, 6.5GB hard disk and a new graphics card ($950).

ENHANCE MULTIMEDIA

Buy a 17-inch monitor, a new sound card, and speakers ($800), or consider a DVD upgrade kit, a new sound card, and speakers ($750).

IMPROVE 3D

Buy a 17-inch monitor and a new graphics card ($700).

INCREASE STORAGE

Add a 5400-rpm 17.2GB hard disk ($800) or 7200-rpm 14.4GB hard disk ($1000), or consider a 2GB Jaz Drive ($750) or a CD-RW drive ($650).

$2000 OR LESS

IMPROVE PERFORMANCE

Stop at $1000, or save your money for a new system later.

ENHANCE MULTIMEDIA

Buy a 17-inch monitor, a new sound card, speakers, and a DVD upgrade kit ($1300).

IMPROVE 3D

Stop at $1000, or save your money for a new system later.

INCREASE STORAGE

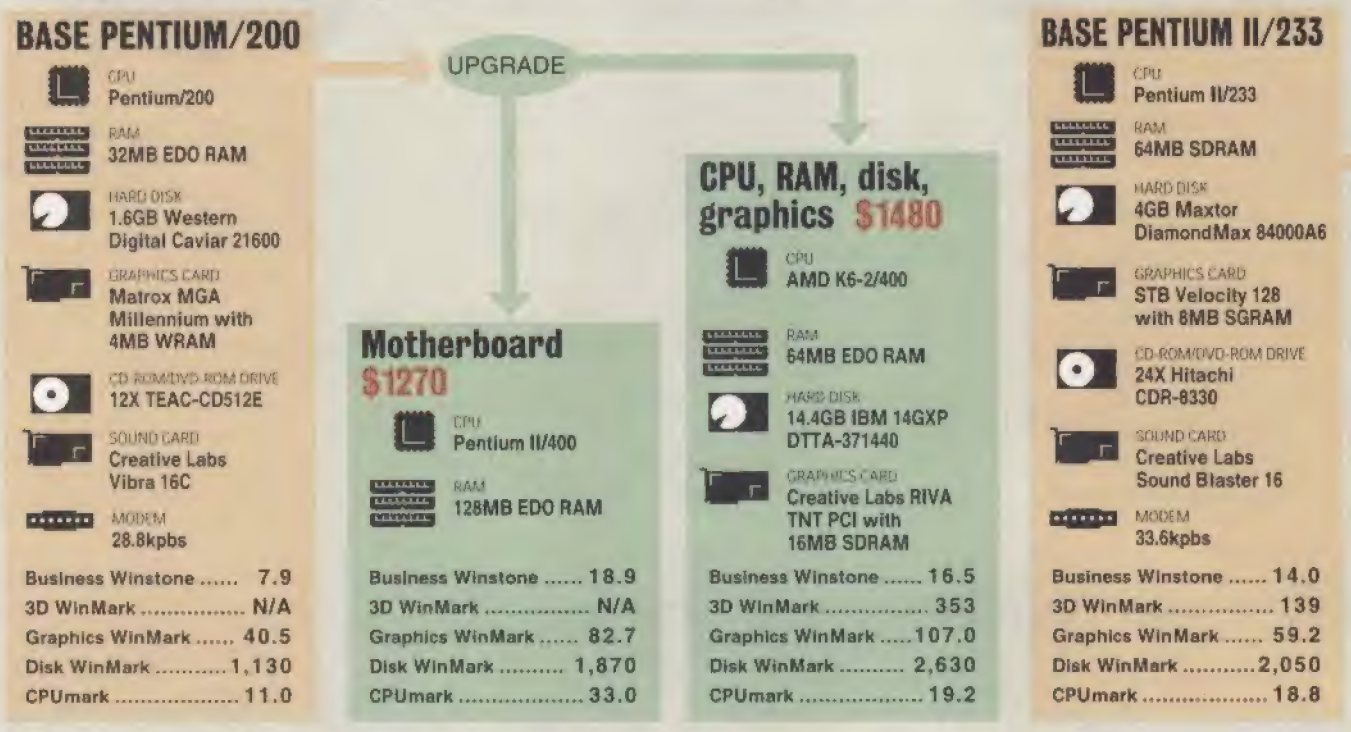
Stop at $1000, or save your money for a new system later.

ILLUSTRATIONS BY DENNIS HARMS

Should You Upgrade or Buy New?

UPGRADE? In almost every case, if you upgrade, you'll end up with better performance and better hardware. But you do miss out on new warranties and special programs that offer benefits beyond the traditional parts-and-labour service. You'll also have to deal with all the troubleshooting problems on your own—which may add up to a significant drain on time and money. Upgrades make a lot of sense for a Pentium II owner looking to extend the life of the system. Targeted upgrades, such as a new powerful graphics card or more memory, will improve performance where you need it, without the problems of a major upgrade or the cost of a new unit.

BUY NEW? If your current PC is less powerful than a Pentium/200, then a value-priced system makes the most sense. A new unit offers you a complete warranty, one point of contact, new software, and new system technology—without



N/A—Not applicable. The unit's graphics card could not complete this test.

make is to increase the memory from 32MB to 64MB. Nothing else comes close. And for the Pentium II, aside from increasing 3D graphics performance via a new graphics adaptor, none of the upgrades gave significant gains on the basis of a percent increase per dollar spent.

PENTIUM 200 UPGRADES

Our base Pentium/200 unit had 32MB of memory, 512KB of L2 cache, a Western Digital Caviar 21600 1.6GB hard disk, and a Matrox Millennium graphics adaptor with 4MB of WRAM. Its performance was just over half that of some of today's mainstream PCs.

The first upgrade we performed was a memory increase. Simply adding 32MB more RAM to this system gave a just over 20 percent boost in the Business Winstone score. And figuring the pair of 16MB EDO SIMMs at $75 apiece (the price when this story was written) amounts to a 0.13 percent increase per dollar. This also gave a 16 percent boost to the Disk WinMark 99 score—for a 0.11 percent per dollar gain. You'll really notice the decreased disk swapping, which gives you faster access to applications and files you have open and lets you run more applications concurrently. Memory upgrades are also easy to perform, taking less than 15 minutes.

"Nothing succeeds like excess" wrote Oscar Wilde, so we poured on the memory. You must replace your original RAM in order to get to 128MB, so the total tab for that upgrade is $400 (four 32MB SIMMs). Counterintuitively, we saw the Winstone score decrease a bit from the levels of the 64MB score. We suspect that's related to the unit's 430HX chip set. With the proper yet more expensive 16K X 11-bit tagRAM, HX chip sets take full advantage of 128MB of RAM by caching above the 64MB memory space; with the less expensive and more common 16K X 8-bit tagRAM, they do not. As a result, adding memory to this level gave only a 0.05-percent-per-dollar return on the Winstone score. You will still see benefit from the RAM, thanks to decreased disk swapping.

What about a faster hard disk? Returning to the 32MB memory configuration, we tried both a Maxtor DiamondMax 91728D8 disk with 17.6GB capacity (about $730 at the time this article was written) and an IBM 146XP DTTA-371440 disk drive with 14.4GB capacity ($730).

Both resulted in noticeable increases in the Business Winstone scores (12 and 14 percent, respectively), but the big gains were in the Business Disk WinMark results. The IBM increased the score by 53 percent, and the Maxtor pushed data through 48 percent faster than the base system. Even this level of gain doesn't give you much on a per-dollar analysis, but the true value of these upgrades isn't in performance: they represent a 9- to nearly 11-fold increase in storage

potential upgrade problems. Those on tight budgets should consider sub-$1500 systems. Everyone else should spend more or do targeted upgrades. A $2000-plus system will be a decent long-term value, and the price is terrific. Make sure to get at least 48MB of memory: it'll give you better performance and help you avoid upgrading your system in the near future.

UPGRADE

RAM, disk, graphics
$1170

RAM
128MB SDRAM

HARD DISK
14.4GB IBM 14GXP DTTA-371440

GRAPHICS CARD
Creative Labs RIVA TNT PCI 16MB SDRAM

Business Winstone	16.0
3D WinMark	357
Graphics WinMark	92.0
Disk WinMark	2,620
CPUmark	18.8

capacity. What this extra capacity is worth to you is an individual matter, depending on how much space you have left on your original hard disk and whether you work with large files, such as those in graphics-editing applications.

Hard disk upgrades used to be far more difficult, because you had to back up and transfer both the data and the operating system piecemeal. Today's hard disks come with software utilities that make these transfers a breeze. Installing the hardware and transferring your data should take about 45 minutes. But if your existing system's BIOS has a hard disk size limit smaller than your new disk, as our base system did, you'll have to install special overlay software that usually comes as part of the upgrade package. Unfortunately, the software does not walk you through an easy install, making the whole process difficult and time-consuming.

Next, we upgraded the graphics adaptor, which took about 15 to 20 minutes. The PCI

Pinpoint Your Best Upgrade

If your system's performance is satisfactory in most respects but one or two applications feel as if they're running in cement shoes, chances are that an upgrade will give your older system a new lease on life and keep you happy with its performance for a few more years.

Slow internet access.

Most likely it's your connection, not your system. Upgrade to a 56k modem (if your ISP and phone lines support it). For even faster connections, look into ISDN, cable modem, or ADSL connections if they are available in your area (see "Fast Connections" in the Internet and I/O section of this story).

Excessive swap file activity.

If your disk thrashes about when you're working with large files or more than one application at a time, add memory. It would benefit you to have at least 256K of secondary processor cache to go along with it.

Slow graphics performance.

First, run at the lowest resolution and colour depth that are sufficient for your needs. Unless you're working with photographs, 256 colour will probably look just as good as 24-bit colour and will put one-third the load on your graphics adaptor. If this doesn't help, consider a graphics adaptor upgrade with a more powerful accelerator onboard. If you want better 3D performance, the only way to get it is through hardware (see "Graphics Accelerators" in the Multimedia section of this story). Also check your system or graphics vendor's Web site for the latest drivers available for your board: Newer drivers typically fix minor bugs and are better optimised, providing faster performance.

Running out of storage space.

The simple solution is to buy another hard disk; prices have never been lower. The decision here is whether to go for more capacity in a 5400rpm drive or slightly less in a faster, 7200rpm drive (see "Hard Disks" in the Core Components section of this story). But consider upgrades that solve more than one problem and cost about the same: For example, a DVD-RAM upgrade gives you 2.6GB of removable storage per cartridge side, and dual-sided cartridges cost about $120—just cents per megabyte. While not as fast as a hard disk, they can hold the programs and data that you don't use very often, handle backup tasks, and provide access to CD and DVD media (see "DVD Drives" in the Multimedia section).

Too many parallel devices.

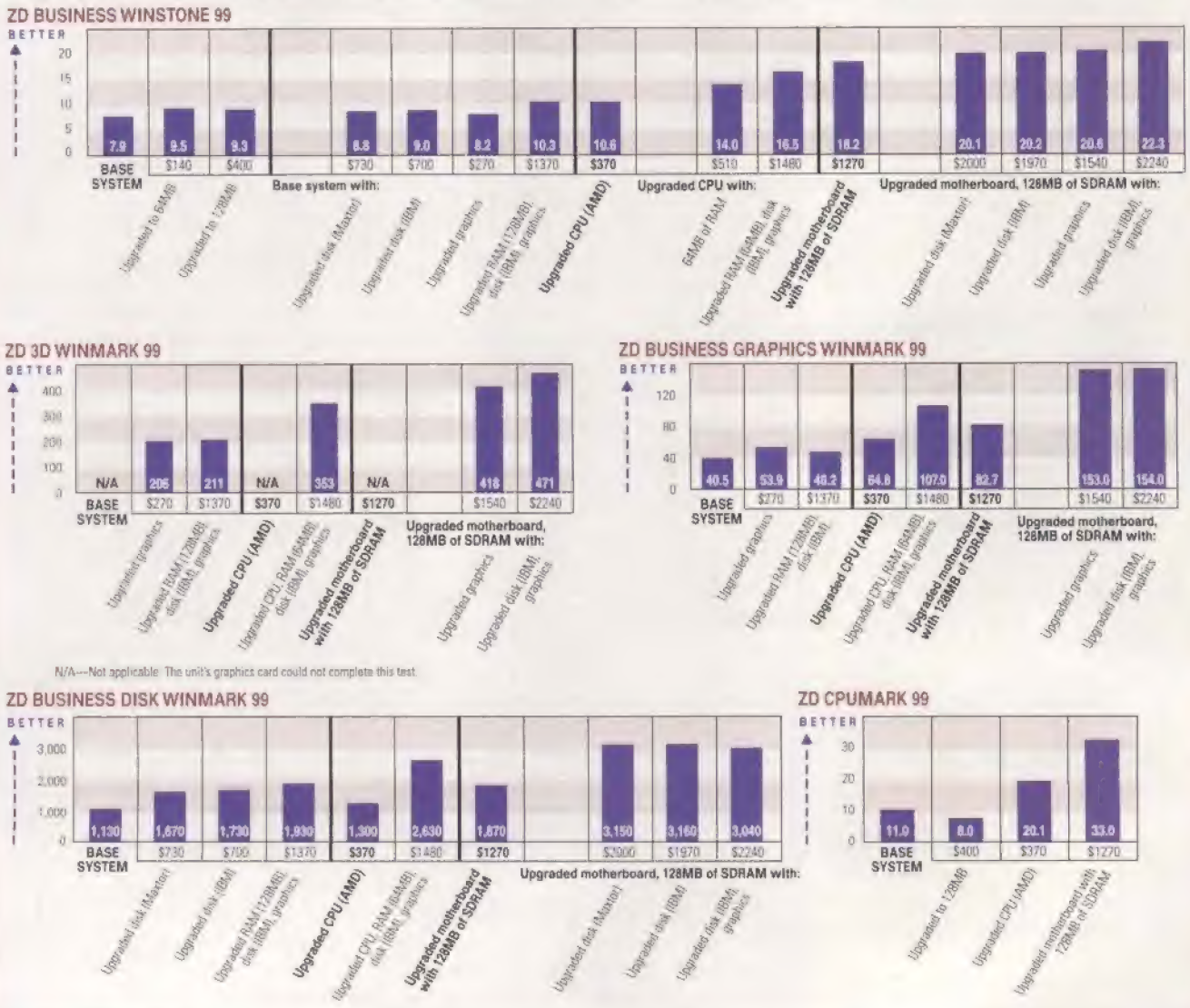
Parallel ports aren't just for printers any more; now CD-ROM drives, scanners, and other devices plug into parallel ports. Unfortunately, they don't always get along when trying to share a port. A second parallel port is affordable and easy to install in any available slot. Or consider getting a SCSI adaptor and replacing the nonprinting peripherals with SCSI versions; you'll get better performance with fewer conflicts (see "Interfaces" in the Internet and I/O section).

All of the above.

If your system is getting too small and too slow, consider a new unit instead of a major upgrade. Not only will you have a single warranty covering the entire system—which makes fixing it easier if something goes wrong—but you'll also have your old unit, which you can network to the new one as a file or print server. —Alfred Poor

TEST RESULTS: PENTIUM/200 SYSTEM AND UPGRADES

Base system: Pentium/200, 32MB of EDO DRAM, 512K L2 cache, 1.6GB Western Digital EIDE hard disk, Matrox Millennium graphics card with 4MB WRAM.
Upgrade parts: *Motherboard*—SuperMicro P6SBA with Pentium II/400, 512K L2 cache ($870), and 128MB of SDRAM (100-MHz DIMM) ($400); *CPU*—PowerLeap AMD K6-2/400 ($370); *RAM*—32MB of EDO SIMM ($140 each); *disk*—17.2GB 5,400-rpm Maxtor Ultra ATA ($730) or 14.4GB 7,200-rpm IBM Ultra ATA ($700); *graphics*—Creative Labs TNT PCI with 16MB of SDRAM ($270). For *RAM* upgrades, we used EDO RAM unless otherwise indicated. The figure in parentheses is the total RAM after the upgrade.



Creative Labs Graphics Blaster, based on the nVidia RIVA TNT chip, provided an increase in 3D graphics performance, because the base model's Matrox Millennium card didn't support the 3D graphics features used by our 3D Winbench test. The new card also boosted the standard Business Graphics WinMark score by about 30 percent. When you factor in the $270 street price of the new card, this yields a 0.11-percent-per-dollar gain on the Graphics WinMark results—not bad.

As might be expected, combining all three upgrades—memory to 128MB, IBM hard disk, and 3D graphics card, for a total cost of $1370—boosted performance by 30 percent. In percent-per-dollar terms, however, the return was modest—just 0.02 with Winstone. You are spending less that you would for a new system, but the drawbacks include no new warranty, a slower modem, and no USB or AGP technology.

BRAIN TRANSPLANT

Next on the list of upgrades was a new CPU. There are many such products available on the market, most of which are based on AMD and Cyrix CPUs. Models from Evergreen (Hypertec, 13 13 07) and Kingston (03 9690 9699) should now be available.

We a motherboard featuring an AMD. As might be expected, the PowerLeap upgrade provided some increased speed, especially in the CPUmark 99 score. The gain on the CPUmark was 82 percent over the base configuration, and the Winstone score increased by over 30 percent. Given the modest price of the upgrade module, this amounted to a 0.22-percent-per-dollar gain with CPUmark. And with Winstone, where performance differences are most noticeable to users, it was just 0.08 percent

BENCHMARK TESTS

Upgrades

PC MAGAZINE AUSTRALIA LABS

More RAM and a new CPU for the Pentium/200-based PC yielded the best performance boost for the money. For Pentium II PCs, upgrading RAM is a good idea, but a better 3D graphics card made a bigger difference.

The **ZD Business Winstone 99** score is in many ways the most important measure when upgrading components. If a new component doesn't significantly improve general system performance as measured by the Winstone tests, you won't see the gain when using the PC. When seeking better performance, look to increase memory first. It's inexpensive, and going from 32MB to 64MB netted large gains, 20 percent for the Pentium/200 and 32 percent for the K6-2. Another upgrade that resulted in a big gain was the move from a Pentium/200 CPU to the K6-2/400. Although somewhat more costly, with 64MB of RAM this upgrade improved performance by 34 and 47 percent, depending on the CPU. Upgrading memory on the Pentium II/233 unit from 64MB to 128MB raised the Winstone score by a much more pedestrian six percent. Upgrading the motherboard gets you the most performance improvement. Our fully decked-out Pentium/200 scored less than half as well as the fully upgraded system with a Pentium II/400 motherboard.

The **ZD 3D WinMark 99** tests measure the graphics card's 3D capabilities. The Matrox Millennium card in the base Pentium/200 was unable to run the test, because it could not support the necessary 3D features, most notably MIP mapping, that are common in today's cards. Upgrading the graphics card yielded a respectable score. When we then upgraded the CPU from the Pentium/200 to the K6-2/400, the combination of the more powerful CPU and AMD's 3DNow! instruction set kicked the 3D performance up by 67.3 percent over the graphics card alone. Substituting the new graphics card in the Pentium II/233 more than doubled that unit's 3D WinMark score.

The final upgrade to a Pentium II/400 motherboard eked out the last bit of 3D power, scoring about 32 percent better than the same configuration with the Pentium II/233.

The **ZD Business Graphics WinMark 99** suite tests 2D graphics capabilities. Our testing shows that upgrading the CPU as well as changing the graphics card will give you better 2D performance. Adding system memory proved to be of little help in 2D performance. Upgrading to a K6-2/400 from a Pentium/200 increased performance by 60 percent. Changing the graphics card in the Pentium/-200 upped performance by a third; on the Pentium II/400 motherboard, it yielded the biggest gain—85 percent.

The **ZD Business Disk WinMark 99** test focuses on the disk subsystem. For our upgrades, we chose a Maxtor DiamondMax 17.2GB drive and a similarly priced IBM Deskstar 14GXP 14.4GB drive. The Maxtor, a top-performing 5400rpm drive, kept pace with the 7200rpm IBM Deskstar, which would typically outperform a 5400rpm disk. In all similarly configured tests, however, the IBM and Maxtor were within three percent of each other. But the new drives scored about 50 percent better than the original 5,200-rpm drive in the Pentium/200 system, thanks mostly to their faster rotational speeds, and they were just over 30 percent faster than the older 5400rpm drive in the Pentium II/233. When we went from the 430HX-based Pentium/200 to the new 440BX-based motherboard, we gained Ultra DMA support, which gave the hard disks their biggest performance boost: 57.5 percent.

Our new **CPUmark 99** test measures the performance of the CPU, both L1 and L2 caches, and main memory. Except for changing the CPU, no other upgrades affect this score. When we upgraded the Pentium/200 system to an AMD K6-2/400 we saw a boost of about 80 percent. One interesting anomaly that we found was the result of the system's caching limitation above 64MB of memory. Though the Intel 430HX chip set can cache up to 512MB of memory, the motherboard needs to be using more expensive 16K-by-11–bit tag RAM to take advantage of this function. The Pentium II system did not use the more expensive tag RAM; thus, the performance actually went down by about 3 percent when we upgraded from 64MB to 128MB.

How We Tested

We tested a Pentium/200-based system and a Pentium II/233–based unit, both running Windows 98. We stripped each PC's start-up configuration of all processes and tasks except for Explorer and Systray, defragmented the hard disk before each test, and let Windows 98 manage virtual memory. We used the newest graphics drivers posted on the graphics card vendor's Web site. We ran all 2-D tests at 1024 x 768 resolution, 32-bit colour and 75Hz refresh. We ran the 3D WinMark tests at 1024 x 768 resolution, 16-bit colour, and 85-Hz refresh, and triple-buffered if the card would allow.

The Pentium/200 system was a Micron Millennia desktop with a Micronics motherboard and the Intel 430HX chip set. We increased memory from 32MB to 64MB and 128MB, using 60ns EDO DRAM SIMMs. We upgraded the original 1.6GB Western Digital Caviar 21600 hard disk (spinning at 5200rpm) to either a 17.2GB Maxtor DiamondMax 91728D8 (5400rpm) or a 14.4GB IBM DTTA-371440 (7200rpm). We also upgraded the graphics card from the original PCI Matrox MGA Millennium with 4MB WRAM to a PCI Creative Labs Graphics Blaster using the nVidia RIVA TNT chip set and 16MB of SDRAM. We upgraded the CPU using a PowerLeap PL-ProMMX chip based on a 400-MHz AMD K6-2. We installed the companion CPU Control Panel utility software for Windows and enabled the Write Allocate feature.

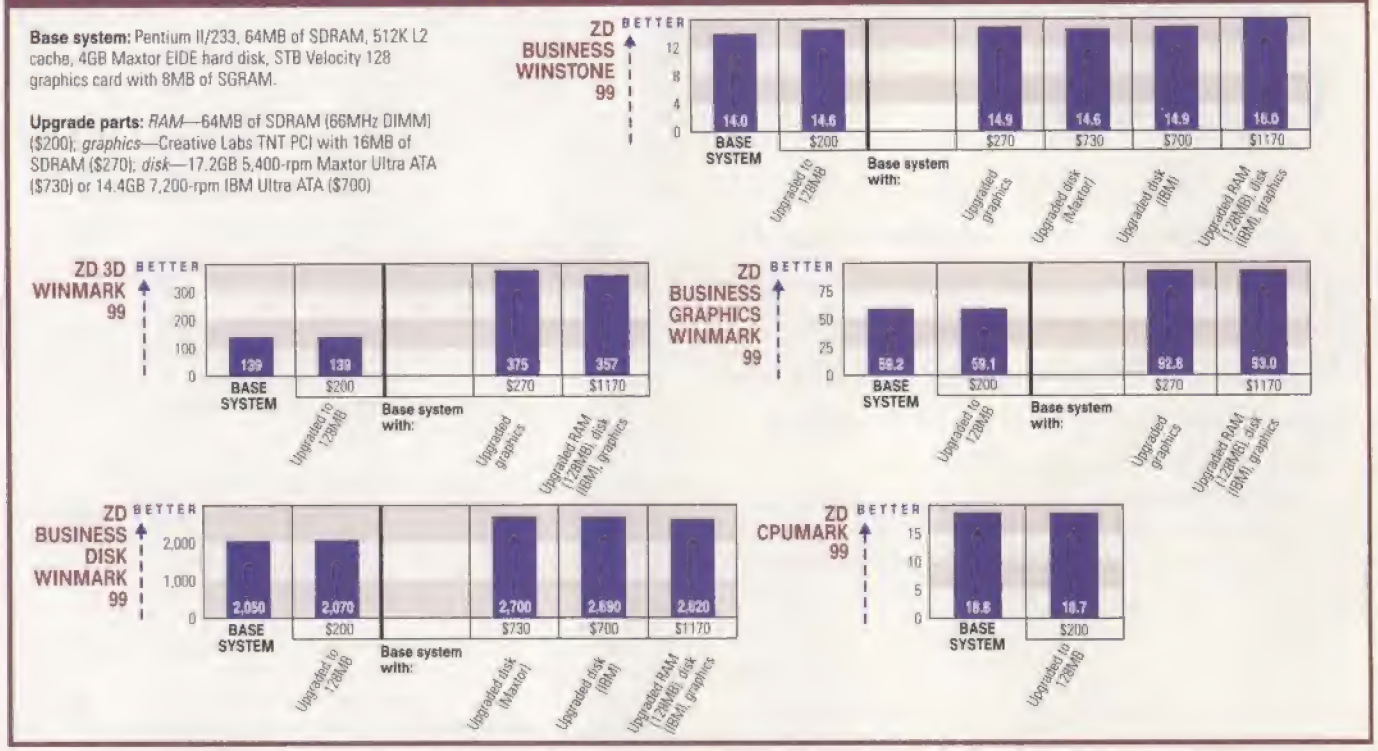
The Pentium II/233-based system was a Micron Millennia XKU tower with an Intel motherboard and Intel's 440LX chip set. We upgraded memory from 64MB to 128MB, using 66MHz non-ECC SDRAM DIMMs. We started with a base Maxtor DiamondMax 84000A6 4GB, 5400rpm hard disk and upgraded to the IBM and Maxtor hard disks listed above. Our base graphics card was an AGP STB Velocity 128 based on the nVidia RIVA 128ZX chip set with 8MB of SGRAM; we upgraded to the AGP version of the aforementioned Graphics Blaster card.

For our motherboard upgrade, we used a SuperMicro P6SBA motherboard with Intel's 440BX chip set, a Pentium II/400 CPU and 128MB of PC 100 non-ECC SDRAM DIMMs. We started with the base hard disk and graphics card used in the Pentium/200 and upgraded to the IBM and Maxtor disks and the AGP version of the Creative Labs Graphics Blaster graphics card.

TEST RESULTS: PENTIUM II/233 AND UPGRADES

Base system: Pentium II/233, 64MB of SDRAM, 512K L2 cache, 4GB Maxtor EIDE hard disk, STB Velocity 128 graphics card with 8MB of SGRAM.

Upgrade parts: *RAM*—64MB of SDRAM (66MHz DIMM) ($200); *graphics*—Creative Labs TNT PCI with 16MB of SDRAM ($270); *disk*—17.2GB 5,400-rpm Maxtor Ultra ATA ($730) or 14.4GB 7,200-rpm IBM Ultra ATA ($700)



per dollar. But this upgrade is enough to bring you to the performance level of one of our new PCs all by itself. You'll notice the improvements most on applications that are processor-intensive, including CAD, 3D gaming, speech recognition, and image processing. The K6-2 also supports 3DNow! technology; for a list of 3DNow!-enabled applications, go to *www.amd.com/products/cpg/k623d/optimized.html*.

Adding memory to the AMD-equipped system to bring it up to 64MB boosted the gains to 78 percent on CPUmark 99. Next, we added in the IBM hard disk upgrade and the Creative Labs TNT adaptor—a total cost of $1620.

MOTHER'S DAY

Having gone this far, it was time to see what a full motherboard upgrade could offer. Upgrading the motherboard rather than just the CPU lets you take advantage of new technologies, such as AGP and the 100MHz bus architecture. On the downside, motherboard upgrades are complex, requiring at least one hour to complete, and even longer to troubleshoot.

But the performance gains are dramatic. Using a SuperMicro P6SBA motherboard, we installed a Pentium II/400 CPU and 128MB of 100MHz SDRAM for a total cost of $1300. Using the same hard disk and graphics card from the original Pentium/200 system, the Business Winstone score still more than doubled and was well over that of a new IBM Aptiva PC, for about $700 less. If you are technically adept and can spare the time, you will see marked improvements with a motherboard upgrade.

Finally, we added in the IBM hard disk and an AGP Creative Labs graphics card for a total upgrade cost of $2000. The Winstone score was nearly three times that of the original system and we now had a fast 3D graphics card and 12GB more space. By this point, however, you've spent at least 2.5 hours performing the upgrades, and you still have more hours ahead of you troubleshooting the new parts. So you're probably better off investing in an equivalently priced new system.

PENTIUM II UPGRADES

We then took our base Pentium II/233 system and ran through a smaller set of similar upgrades. The unit started with 64MB of RAM, a 4GB Maxtor DiamondMax hard disk, and an STB Velocity 128 AGP graphics card with 8MB of SGRAM. We increased RAM to 128MB (at a cost of $200); we also tested the same IBM and Maxtor hard disks and the Creative Labs TNT graphics card in an AGP version.

Almost none of the changes here made a significant gain in terms of percent improvement per dollar, except for the graphics card. When we used the base configuration and changed the card, the Business Graphics WinMark score improved to 0.21 percent per dollar, and the 3D WinMark score rocketed up by 0.62 percent per dollar—the largest gain posted on any test in the entire project. But if you don't run applications that rely on 3D acceleration or perform heavy 2D image editing tasks, this gain is not important.

The hard disk upgrades yielded just over 30 percent better performance over the base unit. You're getting 10GB to 13GB more storage.

The only other upgrade worth mentioning is the upgrade from 64 to 128MB of memory, which paid off for the Winstone score. Another benefit: far less disk swapping. Adding all the upgrades, for a total cost of $1170, actually turned out to have a lower return: a 14 percent performance boost. Stick with targeted upgrades to fix a problem, or buy a new 400MHz Pentium II system. The reviews that follow will help you pick the products that fit your needs and budget.

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CPUs AND MOTHERBOARDS

As our testing proved, installing a new CPU is relatively easy and can significantly improve the performance of an older PC. But to take advantage of the latest PC architecture advancements, such as AGP graphics and the 100MHz system bus, you'll need to replace your entire motherboard with one based on the Intel 440BX chip set. Be warned: this can be somewhat time-consuming and makes sense only if you've already replaced a number of internal components (hard disk drive, graphics card, sound card, DVD drive) and don't want to walk away from that investment.

PROCESSOR UPGRADES

At the moment, there's no way to upgrade an older Pentium machine to an Intel Pentium II or Celeron chip without first upgrading the motherboard. This restricts available processor upgrades to lower-end CPUs, such as the AMD K6-2, IDT WinChip, or standard Pentium. And of these, only the K6-2 even approaches the performance levels of today's high-end machines.

K6-2 upgrade chips are on sale from such companies as Evergreen Technologies and Kingston Technologies. These products can potentially bring an existing Pentium system to the level of an equivalent-speed Pentium II, while providing access to AMD's new 3DNow! graphics technology. All three companies offer upgrade chips at a range of clock speeds, but in a market where even a 266MHz Pentium II is considered slow, we recommend you look at 333MHz or faster chips.

We tested a kit based around the 400MHz version of the K6-2.

After powering down, unplugging, and opening our test system, we lifted the ZIF (zero insertion force) lever on the motherboard and removed its CPU. Our test-bed was a Pentium/200 equipped with 512KB of secondary cache, 32MB of RAM, a modest 1.6GB hard disk, and a Matrox Millennium graphics card. Being careful to slide pin 1 of the PL-ProMMX 400 into pin 1 of the system's ZIF socket, we eased the upgrade chip into place and pushed the ZIF lever back down. We merely had to plug the system in and flip its power switch to reenter Windows. We then installed the bundled software utility to optimise performance.

The chip worked well without any accompanying hardware, software, or BIOS changes. Performance increases were healthy but not spectacular. With the new chip installed, our PC's Winstone score improved by over 20 percent, from 8.0 to 9.7. We then added a second 32MB memory module (priced at under $70) and saw the Winstone score leap to 12.7, an almost 60 percent improvement from the original score. (Today's budget Pentium II/300 machines score in the midteens.)

Unfortunately, the AMD upgrade can't be used with just any aging PC: it is compatible with most Pentium machines running at 75MHz or higher—not all of them. You'll need to check with the upgrade vendor to see whether the CPU can be used with your system.

All of this may be moot later this year if the upcoming **Evergreen AcceleraPCI** lives up to its billing. A Celeron-based upgrade chip that sits on a PCI card, the AcceleraPCI plugs neatly into the bus slots of any existing system with an available PCI slot. The card itself houses the CPU, half of the CPU's chip set, L2 cache, system memory, and possibly some additional hardware. The first ver-

How to Install a Motherboard

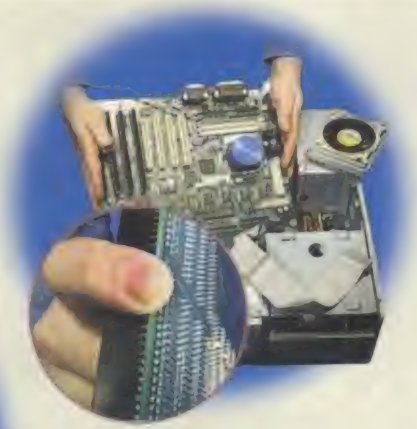
BEFORE YOU START

GROUND YOURSELF

Lightly touch your PC's metal chassis to discharge any current from your body. Then unplug the power cable.

WHAT YOU'LL NEED

1 **GENTLY DISCONNECT** the main power cable, all IDE ribbon cables, the floppy disk drive's cable, any add-in cards, all peripherals, and the leads to all buttons, indicators, and speakers. You may also have to remove the PC's front panel or a fan or drive bay if it's obstructing the motherboard.



2 **REMOVE YOUR EXISTING MOTHERBOARD.** Undo the few screws that hold it down, and lift it from your PC's chassis. This may require some force; make sure you apply pressure evenly across the board. Be careful not to cut yourself on the sharp pins protruding from the underside of the board.

sions will use either a new, socketed incarnation of the 333MHz Celeron or a current K6-2 chip. This is certainly an ingenious invention, but how well it will perform is anyone's guess. (Hypertec, Ph: 13 13 07, www.hypertec.com.au)

MOTHERBOARD UPGRADES

Until the AcceleraPCI arrives, and perhaps even afterward, the best way to upgrade an existing 486, Pentium, or slower Pentium II will be to replace the motherboard. Unfortunately, that is no simple task. In fact, it's major surgery that PC neophytes and the faint of heart should absolutely avoid. Physically adding the new board may not be difficult (it took us about half an hour), but configuring the board to run your OS properly requires hours of work.

It also requires the purchase of several additional hardware devices. At the very least, you'll need a new high-end Pentium II processor (note that the price of the motherboard generally does not include the processor) and a new 100MHz memory module. And you should also opt for a new hard disk and graphics card; old ones can severely hamper performance. But if you've already upgraded these other components, upgrading the motherboard may well be a reasonable next step.

If you choose to take the plunge, your first step is to determine the design of your existing motherboard. Most later Pentium models use ATX designs, but many 486 and early Pentium systems use the older Baby AT standard.

Next, discern whether your system uses an integrated audio chip or an audio peripheral card. If audio is integrated and you'd rather not purchase a new sound card, pick a new motherboard that integrates audio.

Whether you opt for a Baby AT or an ATX board, and whether you choose a board that comes with or without audio, it must in any case use Intel's 440BX chip set. Like past Pentium II chip sets, the 440BX supports AGP; but the 440BX is the first to use Intel's new 100MHz bus, thus alleviating one of the market's longest-standing bottlenecks. Without the 440BX and the fast bus, you won't be able to run Intel's future chips, let alone today's 350-, 400-, and 450MHz Pentium IIs.

To upgrade our ATX-based test-bed, we chose four boxed 440BX motherboards from well-known manufacturers. You may be able to find them at retail outlets, but most are sold primarily to resellers and distributors.

Using a screwdriver, strong hands, and the documentation that came with the boards, we installed each motherboard (for details see "How to Install a Motherboard"). We encountered no major faults and only a few minor glitches. Then, after installing a 400MHz Pentium II, 128MB of memory, a 14GB hard

4 CAREFULLY RECONNECT ALL CABLES AND PERIPHERALS. Using your motherboard's manual, connect all cables, leads, and peripherals. Make sure the light-red strip that runs along the edge of the ribbon cable for your IDE or floppy disk drive connection matches up with "pin 1" of the IDE or floppy disk drive slot being used.

3 INSTALL YOUR NEW MOTHERBOARD. Gently fasten it to your PC's chassis with only one or two screws. Forcefully tightening multiple screws can damage the board's internal circuitry.

5 TURN THE MACHINE ON AND BE PATIENT. Getting the new board to run your operating system may require many hours of work. Have your operating-system CD handy, and be prepared to load drivers, change settings, and reboot many times.

UPGRADE TIPS

CPUs

- To save money, consider a memory upgrade first. Buy a faster processor only if adding new RAM won't satisfy your performance needs.
- Consider buying a new PC, or even a new motherboard (if you're brave). After all, at the moment there's no way to add a Pentium II or Celeron processor to a 486- or Pentium-based motherboard.
- Consider waiting later this year, when Evergreen Technologies will start selling a Celeron upgrade processor that sits on a PCI card and neatly attaches to your existing motherboard. We've yet to test this product, but it may prove a worthwhile and easy upgrade to the P6 platform.
- If your heart is set on an upgrade now, use an AMD K6-2 part from Evergreen or Kingston. These are the only chips that can perform anywhere near the levels of today's new systems.
- Beware of other performance bottlenecks, such as your hard disk or graphics card. These may be as ready for an upgrade as your CPU.

disk, and a Creative Labs AGP graphics card, we tested each product and saw very similar results. All performed as well as many new 400-MHz machines, and all scores fell into a very narrow range.

One excellent product is the **Tyan S1846S/L/A**, priced about $350. This board offers a healthy complement of I/O slots, including three DIMM, two PCI, one ISA, one shared, and one AGP. It also supports Wake on LAN, Ultra-DMA/33, and industry-standard health monitoring.

Fully equipped, the S1846S/L/A scored 21.7 under Winstone, in the middle of the pack. Its Business Graphics WinMark and CPUmark scores—149 and 31.8 respectively—were also high (though slightly lower than those of the SuperMicro board).

Bundling most of the same features as the S1846S/L/A, the **Intel SE440BX-2**, or "Seattle," is typically priced from $340 to $370, depending on whether you opt for audio. It performed only slightly below the S1846S/L/A on speed tests and offers a similar three-year warranty. (Intel, Ph: 02 9937 5800; *www.intel.com.au.*)

The **SuperMicro Super P6SBA** (typically $250 without sound) bested all comers on every speed test. Its basic features are similar to those of the three other products, though it adds an extra ISA slot. Unfortunately, SuperMicro doesn't offer technical support to users over the phone, though it does answer e-mail concerning its boards. (Beyond Computers, Ph: 02 9471 3688; *www.beyondcomputers. com.au.*)

The **Diamond Micronics C400** was the least impressive product we looked at, shipping with a terse setup poster in lieu of a user guide and delivering the poorest test scores by a small margin. But it's competent and inexpensive, providing technology comparable to that of its competitors despite costing under $270 with integrated audio. (Chips and Bits, Ph: 03 9696 1911; *www.diamondmm.com.*)

Any of these boards can raise your machine to the level of a new 400- or 450MHz Pentium II. Of course, once you spend more than $250 on a motherboard, you'll also need to spend roughly $700 on a 400MHz Pentium II, $400 on a 128MB memory module, $700 on a hard disk, and $270 on a graphics card. That's almost as much as a new machine, and it doesn't take into account the hassles of installation.

In the midst of all this, that new $3500 system can start to look mighty attractive. —*Cade Metz*

PC MAGAZINE AUSTRALIA EDITORS' HOT LINKS

Here are some suggestions on where to go for a real-time guide to core-component upgrades. If you're interested in learning more about motherboards, CPUs, and hard disks, you'll find everything you need at these sites.

MicroDesign Resources
www.mdronline.com
A great site for technical information on new processors from AMD, Intel, and others, with articles from Microprocessor Report.

PC Mechanic
http://pcmech.pair.com
A helpful resource for do-it-yourselfers, PC Mechanic discusses how PCs work and the roles of various components. It includes step-by-step upgrade guides and sections on CPUs, motherboards, hard disks, graphics cards, and monitors.

Intel Developers' Site
http://developer.intel.com
Sponsored by Intel, this site has extensive technical information on new and existing Intel products, including processors, motherboards, memory, and peripherals.

Intel Secrets
www.x86.org
Robert Collins has made his mark by exposing many of Intel's "technical secrets," providing very good behind-the-scenes articles and solid technology pieces on Intel motherboards and processors.

AMD
www.amd.com
A rival to Intel, AMD makes the capable and popular K6 processor, bundled in many low-cost PCs. The company's Web site includes extensive technical information on its products, including the latest K6 processors.

IBM Storage Systems Division
www.storage.ibm.com
IBM's Web site includes an in-depth explanation of its magnetoresistive heads, which the company uses in its own hard disks and licenses to other companies as well.

UPGRADE TIPS

Motherboards

- Not comfortable installing PC hardware? Then don't bother. Upgrading a motherboard requires a fair amount of expertise and often hours of work. If you're inexperienced or faint of heart, just buy a new PC.
- Find out your existing motherboard's design: some are Baby AT, others ATX. Check your documentation to be sure you're purchasing the right one to match the PC's chassis and power supply.
- Opt for a motherboard based on the Intel 440BX chip set. Though AMD is competing successfully in the retail market, Intel motherboards, chip sets, and CPUs are best for the latest features and a more promising upgrade path.
- Make sure your new motherboard offers USB and AGP. New Pentium II and Celeron boards are almost always equipped with these new interfaces; a motherboard that lacks them will hamper your ability to add peripherals.
- Check for integrated audio. If your existing motherboard has a built-in audio chip and audio I/O ports, you might want an upgrade board that also has these features—unless you're ready to buy a new sound card.

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HARD DISKS

One of the best ways to boost your PC's usefulness and extend its life span is to increase its hard disk capacity. Desktop drive prices have dropped so low and installation has become so easy—particularly under Microsoft Windows 98—that replacing an existing drive or adding a second one is now a very cost-effective and time-efficient option. For this story, we tested desktop drives from the largest manufacturers.

DESKTOP DISKS

Desktop users should consider drives in the range of 12GB to 17GB (about $470 to $750). All here are 3.5in units built for the standard IDE interface, and all meet the Ultra DMA (ATA-4) specification. Each comes with mounting rails and data cables. And unlike those in past years, each delivers bundled software that easily configures, partitions, and formats your new drive, while helping transfer data from an existing drive to the new one—including boot information.

Upgrading a hard disk in a new system (less than a year old) should not be a problem in most systems; we had no trouble with our 300MHz Pentium II test beds. Older systems, however, typically have BIOSs that can't see partitions greater than 2GB or 8GB. If you are using a hard disk larger than this, you'll need to use the overlay software that's provided with it, which can be intimidating for the less technical to use. If you're worried, the store where you bought the new drive probably offers an install service for a minimal fee.

As for performance, mainstream users won't detect a huge difference from one drive to the next. In fact, on our Winstone 99 test suite (which models real-life application usage), all scores fell within a 0.6-point spread. We saw more noticeable divergences in disk access times and data-transfer rates. So for disk-intensive applications that employ large files (such as video and image editing), a better-performing drive can save a few seconds on every File | Open and File | Save command, which can add up over a day.

The 14.4GB **IBM Deskstar 14GXP** ($800 street), which boasts a rotational speed of 7200rpm, was slightly faster than the competition on our disk access tests, at 13.6 milliseconds (ms). It is bundled with Ontrack Data International's Disk Manager—software for configuring, partitioning, and formatting a new disk as well as for transferring data from an original drive. (IBM, Ph: 13 24 26; *www.ibm.com.au.*)

The 17.2GB **Maxtor DiamondMax 4320** ($730 street) comes with MaxBlast, the company's automated installation software. MaxBlast accurately assesses the drives in the current system and prints out a customized installation guide. If you lack a printer, it indicates on-screen the essential information needed to install the drive in your system. A 5400rpm disk, the Maxtor was a surprisingly competent performer. (Maxtor, Ph: 02 9369 3662; *www.maxtor.com.*)

The 12.7GB **Quantum Fireball EX 12GB** ($480 street) is the only drive here that sells with extra software for special functions. In addition to Ontrack's Disk Manager, the Fireball EX includes the graphics software CorelDraw! 6 Select and Norton Smart Doctor. This 5400rpm drive performed solidly on our speed tests, trailing the pack only on our burst data-transfer tests, where it landed just shy of the IBM disk—a mere six percent slower than the group's average. (Quantum, Ph: 02 9232 1999; *www.quantum.com.*)

To install the 9.1GB **Seagate Medalist Pro 9140** ($500 street), you must first run its animated installation and configura-

How to Install a Hard Disk

BEFORE YOU START

Lightly touch your PC's metal chassis to discharge any current from your body. Then unplug the power cable.

WHAT YOU'LL NEED

1 **BACK UP YOUR MOST IMPORTANT DATA FILE,** turn off your PC, and unplug the power cable. Open your PC case and locate a drive bay, data cable, and power lead that will be used for your new hard disk. You may need to remove the PC's plastic front panel.

2 **MAKE SURE THE JUMPERS** for the old and new drives match the intended use, whether as master, slave, or sole drive on the primary IDE circuit. The manual is usually clear on this point; sometimes the jumper setting choices are printed on the drive itself, or at the vendor's Web site.

UPGRADE TIPS

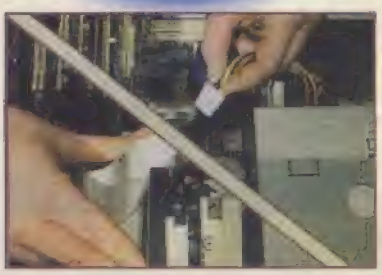
Hard Disks

- If your PC's BIOS doesn't support the capacity of your new drive, you'll have to work around the problem by running utility software (often bundled with the upgrade drive).
- If your operating system doesn't recognise disk partitions larger than 8.4GB, you'll need to configure the new drive into multiple logical drives—or else run utility software (usually bundled) that forces the system to work with larger partitions.
- If your PC has no available power-cable plugs for attaching the new drive, you'll need to buy an internal Y-shaped power-splitter.

tion software. In our labs, we were impressed that the program detected an incorrectly entered model number, recognised the proper drive, and prompted the user to continue with automatic installation. The Medalist Pro performed near the top on all of our speed tests. (Seagate Technology, Ph: 02 9725 3366; *www.seagate.com.*)

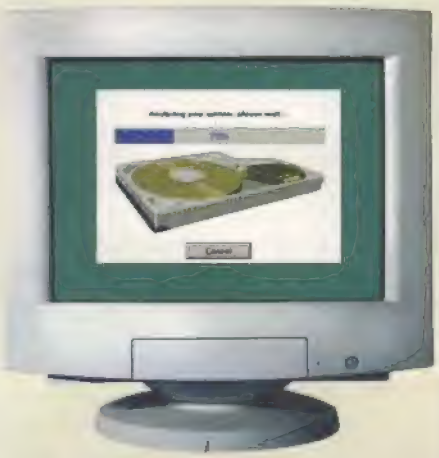
The **Western Digital WD Caviar 13GB** ($550 street) includes a detailed installation guide and user manual. While most users will probably never look at the manual, it's still a valuable reference source. This fine 5400rpm drive topped our Winstone testing by a hair's breadth, though it trailed by an equally tiny margin on our sustained data-transfer rate tests. (Westan, Ph: 03 9563 6775; *www.westerndigital.com.*) —*Bruce Brown*

3 **PLACE THE NEW DRIVE IN THE SELECTED BAY.**



4 **ATTACHED THE PC's IDE ribbon cable and power cable to the drive. Each will probably be keyed to fit only one way.**

5 **CLOSE YOUR PC's COVER, attach the main power cord, and turn on the system. The BIOS should recognise the new hard disk.**



6 **RUN THE HARD DISK INSTALLATION SOFTWARE to partition and format the new drive. Finally, use the bundled software to transfer desired data from the original drive to the new one—including boot information, if necessary.**

PCWEEK AUSTRALIA

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PCWEEK AUSTRALIA

GRAPHICS ACCELERATORS

The graphics board industry is on a roll these days. Prices are down and performance is up, and top-notch 2D/3D combo boards stocked with 16MB of fast SDRAM routinely sell for less than $300. Although new developments will (as always) change the scene in another six to nine months, now is a good time to buy a new card for gaming, graphics, or business use.

For this story, we purchased graphics card upgrade kits from several resellers and ran them through our Winstone, Business Graphics WinMark, and 3D WinMark tests on an NEC Pentium II/300 base machine. We also took an early peek at a preproduction version of the new ATI Rage Fury 128, which promises to be a major player when it begins shipping in earnest later this year.

The growing maturity and acceptance of Microsoft's Direct3D API as a gaming platform provide the most obvious reason to replace an aging graphics card. Current offerings support 32-bit Direct3D graphics at resolutions as high as 1600 x 1200 and have enough off-screen memory to load the large, complex texture maps used in the latest 3D games. Especially appealing as upgrade options are the new one-slot *convergence* boards, which bundle together a range of multimedia features—video capture, TV tuners, and so on—and still deliver great 2D and 3D performance.

Conversely, you can now easily upgrade individual features by adding a PCI-based specialty board to an existing system. Add-in cards based on the 3Dfx Voodoo2 chip set (such as the Diamond Monster 3D II or the STB BlackMagic 3D) can help solve your 3D gaming woes without making you change your graphics card. Other popular add-ins include TV tuners, video-capture cards, and hardware-based DVD decoders.

AVOIDING THE WRONG CARD

Although the AGP bus has made graphics faster and easier for Intel Pentium II and Celeron machines, there are still roadblocks in the upgrade path. For starters, if your PC runs on an AMD processor or a previous-generation Pentium you'll need to stick with PCI. Several lines of currently shipping low-end PCs (including the Compaq Presario, Dell OptiPlex, and IBM Aptiva lines) provide AGP graphics through a soldered-on graphics chip (called a *down* chip). Although they use AGP now, they can't be upgraded with AGP cards in the future. But don't fret: our test results show that topflight PCI-based boards can give these systems a substantial performance boost.

If you recently purchased an AGP2X machine that uses Intel's backplane NLX motherboard design, you'll need to check prospective upgrade cards to verify that they'll physically fit in your system. An NLX motherboard requires a different bracket to attach the graphics card to the rear of the computer case, constraining the placement of the 15-pin monitor port as well as the height and length of the card itself.

COMPARING THE PRODUCTS

The **Creative Labs Graphics Blaster RIVA TNT** offers fine performance thanks to its 16MB of SDRAM and excellent implementation of the nVidia RIVA TNT accelerator. The card posted exceptional scores on all of our 2D, 3D, and system-level tests and should perform even better in faster systems, such as the new 400- and 450MHz Pentium IIs. ($420 RRP; Creative Pacific, Ph: 02 9906 8887; *www.cppl.com.au.*)

From Diamond Multimedia, the 16MB Voodoo Banshee–based **Diamond Monster Fusion** performed well in both AGP and PCI versions. Indeed, the PCI model earns our Editors' Choice as the top 2D and 3D choice for low-end systems (such as our Micron Pentium/200 baseline machine). In fact, the Monster Fusion posted a higher 3D WinMark score on our Pentium/200 test-bed PC than many cards did on a Dell Pentium II/400 in last November's roundup. A true gamer's delight, the Monster Fusion ships with Motocross Madness 2 and Unreal, and the board supports 3Dfx's GLide API as well as Direct3D and OpenGL. ($310; Chips and Bits, Ph: 03 9696 1911; *www.diamondmm.com.*)

The inexpensive, AGP-only **Matrox Millennium G200** performed well on our Winstone and Graphics WinMark tests for this roundup, a fraction below the top-scoring Diamond Monster Fusion.

UPGRADE TIPS

Graphics Accelerators

- Some vendors still can't get plug-and-play right. To ease setup woes, before installing a new card, open Windows' Display Properties screen and change your adaptor setting to "Standard Display Adapter (VGA)." Then turn off the machine and install the new card.
- The latest Intel NLX motherboards require a new style of bracket for add-in cards. Some graphics cards can be adapted for this system simply by unscrewing their brackets and replacing them with NLX-compliant versions, but others can't, because their 15-pin monitor connectors are mounted either too high or too low on the cards. Before you buy, check whether a new card will work with your system.
- Some current PCI graphics adapters require PCI 2.0 or PCI 2.1 compliance. Verify your system's PCI compliance level before attempting to upgrade the graphics card.
- Many low-end computers support AGP graphics via a "down" accelerator chip hardwired onto the motherboard; this is incompatible with a slot-based AGP card. If you have a PC that uses a down chip, you'll have to buy a PCI card if you're planning to upgrade.
- Some multifunction graphics cards are incompatible with hardware DVD decoders. If you plan to watch DVD movies on your PC, check carefully for this feature.

Diamond Monster Fusion. But this 8MB card's 3-D performance remained well behind that of the 16MB RIVA TNT–and Voodoo Banshee–based boards we reviewed. (A memory upgrade to 16MB is available for about $45.) The G200's signal quality is very good, and the company offers a wide range of add-in daughtercards, including a hardware DVD decoder, digital flat-panel connector, and TV tuner. ($90 street; Matrox Graphics Inc., Dorval, Quebec, Canada; 800-361-1408, 514-685-7230; *www.matrox.com.*)

From the same company, the 8MB PCI-based Matrox Marvel G200-TV is a welcome addition to the convergence-board set, though its performance on our 200-MHz test-bed was disappointing. Under Winstone, the Marvel finished roughly 5 percent behind the pack-leading Monster Fusion, and its scores went downhill from there: The Banshee-based PCI Monster Fusion was almost 50 percent faster than the Marvel on our Graphics WinMark tests and more than three times as fast on our 3D WinMark tests. Still, the bundled goodies are impressive, including a TV tuner, frame-capture circuitry, and video-conferencing capability. Unlike its convergence-board competitors, the Marvel uses an external box for its audio and video connections, easing back-of-the-PC connection woes ($280 street; Matrox Graphics Inc., Dorval, Quebec, Canada; 800-361-1408, 514-685-7230; *www.matrox.com.*)

Combine its rock-bottom price, 16MB of SDRAM, and solid performance profile and the Metabyte Wicked3D Vengeance presents an attractive upgrade, especially for low-end Pentium-class machines. Its Winstone, Business Graphics WinMark, and 3D WinMark results were slightly lower than those of the Monster Fusion—but always within striking distance—yielding a firm second-place finish among our PCI cards. ($130 street; Metabyte Inc., Fremont, CA; 510-494-9700; *www.metabyte.com.*)

STB Systems, soon to be purchased by chip maker 3Dfx Interactive, ironically has a terrific contender in the RIVA TNT–based STB Velocity 4400. This 16MB card was the fastest 3D WinMark performer in the roundup, and its 2-D scores were but half a step behind those of the AGP version of the Diamond Monster Fusion. When you add a smooth and easy setup procedure, solid configuration utilities, and a fire-sale price, what's not to like? ($140 street; STB Systems Inc., Richardson, TX; 972-234-8750; *www.stb.com.*)

The Rage Fury card, from ATI Technologies—which wasn't ready in time for this roundup—is expected to include a 128-bit engine, 32MB of SDRAM, dual instruction pipelines, and superscalar architecture that can handle DirectX 6 multitexturing in a single pass. The Rage Fury is reportedly the first mainstream graphics chip to support high-resolution true-color 3-D without a performance hit. Toss in four-tap video filtering and some motion-compensation circuitry and you have the first graphics card with a real DVD-playback assist.—*Jon Hill*

PC MAGAZINE AUSTRALIA EDITORS' HOT LINKS

www.pcmag.com/hotlinks
For the most comprehensive multimedia product reviews on the Web, visit www.pcmag.com/hotlinks. *To learn more about graphics, video, sound, and DVD, poke around these other sites.*

DVD FAQ
www.videodiscovery.com/vdyweb/dvd/dvdfaq.html
Maintained by Jim Taylor, the best FAQ on the Web for DVD technology describes all aspects of DVD audio, video, and storage—and it's very well organized.

Dolby Labs Technical Info
www.dolby.com/tech
The best site for getting the history and details on Dolby Digital and the 5.1-channel surround sound standard.

Aureal A3D
www.a3d.com
Aureal Semiconductor's A3D technology provides the most vivid and realistic digital sound we've heard yet. Peruse this Web site to learn more about how it works.

Creative Labs Environmental Audio
www.soundblaster.com/eaudio
This site explores and explains Creative Labs' EAX 3-D sound technology, which is the main competitor to Aureal's A3D.

Sonera Technology's DisplayMate
www.displaymate.com
DisplayMate is an excellent tool for evaluating, calibrating, and tuning your CRT or LCD monitor. The company's Web site delivers sample test screens and tips on getting the most from your graphics card and monitor.

Today's Powerful Graphics Chips

Today, most accelerators can deliver stunning visual effects and high frame rates in immersive 3-D games while zipping through standard 2-D office tasks without a hitch. The best models stand out for their special quality-enhancement techniques and for features such as DVD video support and bundled LCD controllers.

In recent reviews, we've seen the nVidia RIVA TNT processor edge out the competition on speed tests, thanks to its 128-bit local memory interface and dual 3-D rendering pipelines equipped with flexible texture-mapping engines. It doesn't include hardware-based DVD video support, however. Close on its heels has been the 3Dfx Voodoo Banshee, which runs all GLide games and comes with one of the best VGA cores around.

The Matrox MGA-200 chip produces one of the clearest video signals we've seen, and its excellent 2-D performance is paired with 3-D that's more than ample for business users (though not gamers).

The new ATI Rage 128 chip promises class-leading 3-D performance with support for 32MB of local memory for ultra-high-resolution rendering. Still no word, as of this writing, on the much-anticipated 3Dlabs Permedia 3, with its unusual, efficient texture optimizations and integrated LCD controller.

Less expensive (and less robust) options are also available from S3 and Intel. No matter which chip you buy, be sure to tailor your choice to your own needs—whether you're a gamer or an office user, for instance—while keeping the door open for further upgrades in the future.—Josh Levy

MONITORS

There's one upgrade you can make to your PC that will have absolutely no effect on how fast it runs but will still have a profound effect on your computing experience: buying a new monitor. Today's newest 17- and 19in displays provide better image quality than ever before, thanks to narrower dot pitches that enhance sharpness and increased support for high refresh rates to avoid flicker. Here are some examples:

19IN MONITORS

The **Mitsubishi Diamond Pro 900u** gives you incredible bang for the buck. The Diamondtron NF delivers a top refresh rate of 85Hz at 1280 x 1024 and 75Hz at 1600 x 1200, and a veiwable size of 18 inches.

The Diamond Pro 900u includes an internal USB hub with two upstream and three downstream ports, one of which is on the front panel for quick device connections. A front-mounted button makes it easy to switch between two PCs, either of which can control the monitor via software and an upstream USB connection. On-screen controls are excellent.

During our testing we saw sharp colour and screen focus, with only minimally noticeable DisplayMate flaws. ($2019 RRP; Mitsubishi Electronics, Ph: 02 9684 7260; *www.mitsubishi-display.com.*)

Sony's latest flat-panel CRT monitor, the **Sony GDM-F400**, has the smallest stripe pitch and arguably the best display quality here. The FD Trinitron has a consistent 0.22-mm grille pitch across the screen. The top resolution is 1600 x 1200 at 85Hz, which is further enhanced by the small grille pitch. Additional image control components include the Sony HiDensity Electron Gun with Enhanced Elliptical Correction System and GeoLock Plus circuitry, all to help ensure a smoother and more solid display.

The front panel has an input-source selection button, as well as a joystick-like tool called the DisplayMouse for navigating the on-screen menu. An upstream USB port sits on the back of the monitor, with two downstream ports on each side of the monitor base. In our labs, we saw dead-on image focus with great colors and no noticeable moiré patterning. The GDM-F400 is a terrific choice. (Price TBA; Sony Electronics, Ph: 02 9887 6666; *www.sony.com.au.*)

A very fine, well-thought-out monitor, the **ViewSonic PT795** boasts a maximum resolution of 1920 x 1440 at 73Hz, but images looked better to us at 1600 x 1200 (at 87Hz) and 1280 x 1024 (at 101Hz). USB connectivity consists of one upstream and four downstream ports, with two of each on the left side and two of each on the right. There are two menu buttons for on-screen image controls, one for the full set of controls and one for just brightness and contrast—a convenient grouping.

During DisplayMate testing, the ViewSonic revealed only minor moiré patterning, which was controllable with the on-screen image adjustments. Colour convergence was excellent, and focus was very good, though we noticed minor frame pulsing during full-screen power regulation tests. ($2495 RRP; Chips and Bits, Ph: 03 9696 1911; *www.viewsonic.com.*)

17IN MONITORS

With its "short length" design, the **Panasonic PL70** is one way to win back a bit of desk real estate. With a dot pitch of 0.25 mm and a viewable area of just under 16 inches, the PL70 is capable of resolutions of up to 1280 x 1024 at a 88Hz refresh rate.

Moiré controls were extremely effective, and the screen geometry and image regulation were excellent. ($1320 RRP; Panasonic Computer, Ph: 13 26 00; *www.panasonic.com.au.*)

The **NEC MultiSync E750** isn't a flat-screen CRT, but as a past Editors' Choice in this monitor size, we include it for comparison purposes. Its image quality should suit most mainstream business needs. With a diagonal viewable size of 15.6 inches, a 0.22-mm stripe pitch, and an NEC-made CromaClear Invar shadow mask, it's capable of up to 1600 x 1200 at 75Hz.

During our testing, colour uniformity was good, and vertical and horizontal lines appeared to have equal thickness. Convergence and screen geometry were excellent ($1240 RRP; NEC, Ph: 1800 812 796; *www.nectech.com.*)

THE LCD OPTION

If budget is less of a constraint, you may want to consider an LCD monitor as an upgrade. These displays weigh just a fraction of a CRT of similar diagonal screen size and take up much less desk space. They also provide breathtakingly sharp images. If you want the best image quality in a flat monitor, consider getting one with a digital interface. A few graphics adaptors are designed to work with both digital and analog monitors, but it is likely that your existing system does not include this feature, so you will also need to upgrade your graphics adaptor. *—Bruce Brown and Alfred Poor*

UPGRADE TIPS

Monitors

- Don't run the refresh rate faster than necessary; it can degrade image sharpness. Start at the lowest setting and increase the rate until you no longer see flicker in the screen.
- Similarly, don't use a higher colour depth than necessary, to avoid fuzziness. For example, if 16-bit colour is enough for your applications, don't change your settings to 32-bit.
- Avoid putting your monitor in front of a window or bright light source, to avoid reflections in the screen.
- Adjust your monitor to produce the best possible picture. Increase the brightness so that dark greys are visible, but not so much that true-black backgrounds start to turn grey. To adjust light shades, use the Contrast setting.
- Take frequent "eye breaks" to help reduce eyestrain and fatigue. Alternately focus on objects close to you and on objects as far away as possible.

SOUND CARDS

It wasn't too long ago that standalone sound boards looked like an endangered species, thanks to new integrated sound chips appearing on PC motherboards. Then along came DirectSound3D (DS3D), a key component of Microsoft's DirectX API suite that defined a standard way to position sounds in 3D space above, below, or even behind the listener. The industry quickly embraced the new standard, making positional 3D sound effects this year's hottest new feature and making 3D chip sets the hottest addition to new sound cards, especially for playing games and listening to—or writing—music.

The most sophisticated technology is Aureal Semiconductor's A3D 2.0, which runs off the company's Vortex 2 processor. A3D's Wavetracer function creates a physical model of an acoustic environment, including reflective surfaces, variable sound sources, and a number of other effects that simulate sound coming from around corners, through walls, and across distances. A competitor is Creative Labs' EAX, which, though less advanced, compensates by bundling a variety of special enhancement features, including a number of preset acoustic environments.

Another factor helping jump-start sound technology is the increasing popularity of DVD. Playing a 5.1-channel DVD soundtrack requires a system with either a built-in Dolby Digital decoder and six speaker outputs, or a digital output that can send raw data to an off-board decoder.

For this roundup, we tested four popular sound cards on a 266MHz Pentium II PC with 32MB of RAM, running Microsoft Windows 98. To test performance—especially in 3D—we ran Audio WinBench 99 and a few canned videos from vendors.

CREATIVE LABS SOUND BLASTER LIVE!

The one card we tested that costs more than $400 is the Creative Labs Sound Blaster Live! ($499). But the price is easy to justify. Resting atop the main board, which is equipped with four speaker outputs, is a secondary breakout card that consumes one backplane space but no slots. The card adds S/PDIF (short for *Sony/Philips Digital Interface*) input and output ports, a digital DIN connector for 5.1-channel systems, and mini-DIN jacks that let you attach a joystick and an external MIDI module. Documentation is excellent, and installation took us only 10 minutes. The card's EAX sound technology generated convincing positional effects.

On our 266MHz Pentium II test-bed, Audio WinBench 99 reported only 10 percent CPU utilisation while the board was playing 32 simultaneous high-overhead 44.1kHz DS3D audio streams. It reported a mere 1.5 percent utilisation when the board played 32 standard DirectSound streams. The 64-voice hardware synth produced acceptable sound, and the software synth generated accurate MIDI.

Despite its higher price, the Sound Blaster Live!'s over-the-top feature set and software bundle make it a good choice for just about any sound-processing task. ($499; Creative Pacific, Ph: ; *www.sblive.com.*)

DIAMOND MONSTER SOUND MX300

The latest from Diamond Multimedia has fewer bells and whistles than the Sound Blaster Live!, but in many ways it's more impressive. In addition to four-channel output, a generous software bundle, and foolproof setup routines, the Monster Sound boasts some of the most powerful MIDI and 3D we've seen. Its Aureal Vortex 2 chip can accelerate up to 96 DirectSound and 16 DirectSound3D audio streams and provides a 320-voice synthesizer that produces smooth, detailed General MIDI and Roland GS output.

The Monster Sound supports a broad selection of algorithms—including DS3D, A3D, and EAX—plus MPEG-3 encoding and playback and the DOS-based Sound Blaster Pro standard. Its Dolby Digital and software MPEG features can remix 5.1-channel DVD sound tracks for four-speaker playback, and an optional daughterboard, which should be shipping by the time you read this, will add S/PDIF I/O for true six-speaker Dolby Digital output.

PC MAGAZINE AUSTRALIA EDITORS' CHOICE

Our only beef is the card's high CPU utilisation. It used over 7 percent of the CPU's resources to render 32 DirectSound voices and consumed a whopping 60 percent when playing 32 DirectSound3D voices. ($229; Chips and Bits, Ph: 03 9696 1911; *www.diamondmm.com.*)

YAMAHA WAVEFORCE 192 DIGITAL

The Yamaha WaveForce 192 Digital is the lowest-priced accelerator we've seen with digital-output capabilities, but it can accelerate only eight simultaneous DirectSound3D voices, resulting in high

UPGRADE TIPS

Sound Cards

- Buy PCI, not ISA. Even plug-and-play ISA sound boards can be torture to set up, and virtually all of the latest sound chips require PCI to deliver top performance.
- If you expect to use your PC to play DVDs with Dolby Digital 5.1-channel sound, choose a card with an S/PDIF digital output. You'll need it to drive your multichannel surround-sound speaker system.
- Be sure your computer's chassis has enough room to hold your new sound board. Many new boards consume two backplane spaces, and others require an optional breakout card or daughterboard to add functions such as digital I/O or four-speaker output.
- Don't assume you'll be able to reuse the CD audio cable currently plugged into your motherboard. Many older motherboards aren't furnished with today's standard CD connectors—a must for the latest sound cards. If you need one, check the board vendor or a local computer parts store.
- Choose a board that off-loads processor-intensive tasks to a sound-processing chip, such as the Aureal Vortex 2 or the E-mu EMU10K1. Why spend money on a new upgrade card that will only slow down your machine?

SPEAKERS

CPU utilisation on DS3D titles (66 percent when playing 32 44.1kHz voices). It lacks 4-channel output, and its minipin digital-output is problematic, requiring an adapter to work with RCA-style S/PDIF ports.

Most frustrating is the WaveForce's three-synthesiser MIDI implementation. A flexible, 64-voice hardware synth supports General MIDI, Roland GS, and XG patch sets. Yamaha's S-YXG50 general-purpose software synth adds another 128 voices, but wind instruments are played by a different software synth that uses physical modelling. In hands-on testing, hardware voices sounded fine but many patches were distant and cramped, and the physical-modelling synth often generated distortion.

The WaveForce does include a competitive software bundle and 3D spatialization capabilities. It also supports DS3D, A3D 1.0, and CRL's Sensaura 3D sound technology, which can move sounds disorientingly close to your ear. ($159; Peripheral Sources International, Ph: 03 9878 8611; *www.yamaha.com.*)

UPGRADE TIPS

Speakers

- Speakers with similar features can sound very different, so read reviews, audition friends' systems, and patronise only stores that let you listen before you buy.
- Experiment with placing your speakers around the room. Position the satellites so that a mono signal appears to be at dead center, and move the subwoofer closer to a back wall to increase the bass.
- Don't buy a USB speaker unless you're running Windows 98. Windows 95's USB audio drivers can't stream digital audio over the USB bus.
- When buying a multichannel speaker system, make sure your sound board has the correct outputs. You'll need a digital S/PDIF output for 5.1 channels.

Upgrading your PC's speaker system used to be pretty straightforward: You simply looked for a model with the highest power ratings and the heftiest subwoofer you could afford. These days it's not so simple. Late-breaking technologies—such as flat-panel drivers, USB digital sound, and multichannel surround audio—have generated all sorts of exotic new designs. At the same time, the latest generation of traditional analogue desktop speakers sound better and cost less than ever before.

ANALOGUE SYSTEMS

A fine model is the **Altec Lansing ACS45.1**. Combining the familiar ACS43 PowerCube satellites with a powerful new bass module, it's a good all-around performer with high volume levels and a solid low end, despite ho-hum clarity, spaciousness, and imaging—and a boomy subwoofer. But it lacks major flaws and delivers exactly the kind of sound many users want at an affordable price. ($199; Innovision, Ph: 03 5831 8833; *www.innovision.com.au.*)

The **Bose MediaMate** is a terrific two-piece system. Transparent, uncolored, and with a high end that seems to go on forever, it produces breathtaking sound; the only flaw is its lack of a bass unit, which reduces dynamic range and virtually eliminates output in the lowest registers. ($799; Bose Australia, Ph: 02 9204 6111; *www.bose.com.*)

The classic three-piece **Cambridge SoundWorks** system is no longer head and shoulders above the competition, but its perfectly matched components produce smooth musical output and a tight low end. ($399. Creative Pacific, Ph: 02 9906 8887; *www.cppl.com.au.*)

USB SYSTEMS

The biggest problem with the above speakers is that they run off the relatively noisy analogue signals generated by your computer's CD player or sound board. One solution is to upgrade to a digital system, which accepts virtually noise-free input through the USB bus. USB speakers also offer nifty features like on-screen menus and bundled sound applets. But installation can be complicated, requiring you to load multiple drivers and utility software. They also have stringent system requirements, including Windows 98 and a CD player that can stream digital audio.

One of the first USB models on the market was the **Altec Lansing Digital PowerCube ADA70**, a three-piece system with the same bass module as the ACS45.1. Its minimal USB features merely add volume and tone controls to the standard Windows mixer, and its sound quality suffers from a mediocre high end, fuzzy imaging, and limited volume. ($299; Innovision, Ph: 03 5831 8833; *www.innovision.com.au.*)

DOLBY DIGITAL SYSTEMS

The DVD industry hasn't yet hit its stride, but it has already begun to spawn desktop surround-sound systems that support the Dolby Digital 5.1-channel format (five full-range speakers and one subwoofer). Most include Dolby Digital decoders, and many are compatible with older surround technologies like Dolby Pro Logic. But they need PCs with appropriate software and either multichannel analogue outputs or digital I/O connectors for surround effects.

The soon-to-be-realeased **Cambridge SoundWorks DeskTop Theatre 5.1** is the best-sounding 5.1-channel system today. It includes four tiny Cambridge PC Works satellites, one larger SoundWorks centre-channel satellite, an off-board decoder, and a PC Works subwoofer. Installation is straightforward, though routing the system's maze of cabling took us close to an hour. At higher volumes, the system's high end became harsh and its subwoofer petered out, but at moderate volumes, it filled the room with beautifully uncoloured, detailed sound. The easy-to-use decoder accepts Dolby Digital, Pro Logic, and analogue signals. (Price TBA; Creative Pacific, Ph: 02 9906 8887; *www.cppl.com.au.*) PC

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PENTIUM III HITS 500

We Lab Test some of the latest PCs to incorporate Intel's next-generation Pentium III processor.

By Steven Turvey & Cade Metz

When the sequel is successful, Part III is sure to follow. A year and a half after the debut of the Pentium II, Intel has introduced the Pentium III, a chip offering faster clock speeds than its predecessor as well as 70 new instructions that improve—in certain situations—the performance of such operations as Internet video compression and speech recognition, as well as 3D geometry processing and 2D image editing.

Initially available at 450 and 500MHz, the Pentium III provides marginal improvements under existing software, but it's still worth the while for the PC enthusiast. Pentium III systems are priced only slightly higher than Pentium II/450 PCs so there's little reason to look elsewhere if you're shopping at the top of the market. And if you're a DVD enthusiast, you'll be glad to know that the chip can bring software playback to the same level as hardware playback for most common viewing—really.

Yet the chip could soon face competition from two AMD CPUs equipped with AMD's 3DNow! technology, a set of multimedia-centric instructions that has a slight head start on the Pentium III's set, known as Streaming SIMD (Single instruction, multiple data) Extensions (SSE). The Pentium III has also been the source of controversy recently, being the first Intel chip to use a new digital ID that many see as an infringement on the privacy of PC owners.

■ 50 new SIMD floating-point instructions and 8 new dedicated floating-point registers can speed up the processing of floating-point calculations in scientific and engineering applications, among others.

■ 12 new media instructions for MMX integer functions can speed up MPEG-2 encoding as well as improve speech recognition.

■ A controversial new feature—the processor serial number—is meant to aid network and e-commerce security, but some fear it will lead to loss of privacy.

Application of filters, such as the Adobe Photoshop Wave filter shown here, which use the new media instructions, will also speed up.

Specific 3D functions, such as lighting and transformation calculations, used in 3D graphics packages as well as 3D games, will be faster.

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Editors' Choice

- Persica 3000

PC MAGAZINE AUSTRALIA EDITORS' CHOICE

Consider the performance of the five high-end workstations in this comparison: there's only a whisker of difference between their performances.

Therefore, the only valid benchmark remaining is the individual system's value for money: what you get and what you pay for it. The biggest bang for buck is undoubtedly delivered by the Persica 3000 at just under $3300. The system does not stand out particularly in any other area, but it has good performance, a good build quality, a good monitor, a good modem and a good multimedia system. We could not really fault the system anywhere although if it were up to us we would upgrade the speakers and sound card, but even then it should still come in at a lower price than any other system tested.

If you hanker for a name brand systemlike the Dell or Gateway, the former is more expensive but comes packed with goodies. However, the Gateway is $600 cheaper and also has a very good sound system (although its monitor is only a 17in and the DVD drive lacks an attendant decoder card).

As an aside, the Elite certainly deserves a mention at this point. Even though the system was supplied as a server, replace its graphics card with a TNT and plug in a good sound card with a snappy set of speakers and you would have one hell of a workstation with mass storage bays to burn.

Dell Computer Australia

Dell Dimension XPS T500

One of the most expensive systems tested, the Dell is like a breath of fresh air in this comparison. Why? Because it does not entirely conform to the fairly strict "dress-code" of the other Aussie assembled systems. Upon arrival the Dell was only equipped with a PIII-450 and given that all the other systems came with 500MHz CPUs, with Dell's consent we upgraded the system to a PIII-500 for testing. The Dell arrived quite early so we had the luxury of time to correct any inconsistencies.

The Dell was also packed with multimedia goodies, a DVD drive and encoder, a Turtle Beach sound card, a US Robotics modem and an impressive Altec Lansing five-speaker system with a footstool sized subwoofer. Sound quality from the speaker system was great, certainly more rich and mellow than the smaller and less expensive Cambridge speakers we saw. The large subwoofer had more than adequate grunt.

Dell Dimension XPS T500

The system was bundled with the DVD movie "Sphere", by Michael Crichton, which many of the Test Lab staff had not seen (surprising given their Sci-Fi tastes). As a consequence the speakers Dolby surround sound got quite a workout. There's been a lot of talk of integrating the PC into your entertainment system—Dell's doing it. In particular, the Dell system managed to overcome one of the little annoyances of sitting back with several friends and watching a DVD movie by providing a remote control so that the speakers can be adjusted from the comfort of your viewing position.

The case is a custom designed job—all plastic with metal RF shielding—and as a consequence has some interesting features. The hard drive is mounted vertically at the front of the case just below four 3.5in bays and a pair of 5.25in bays—good hard drive potential for a relatively short midi tower case. The motherboard does not have a heatsink on the BX chipset and the processor does not feature its own cooling fan, just a rather small heatsink. Mounted just behind the CPU, however, is a thumping big extraction fan whose shroud directed airflow is more than adequate for keeping the CPU and chipset system running cool.

The motherboard caters for up to 768MB of SDRAM, but only appears to have a single CPU clock frequency of 100MHz and multipliers from 2 to 5 times.

The system continued to impress with a 19in monitor with oodles of video bandwidth. The image quality was superb and given the viewable area was just on 17.9in, 1600 x 1200 screen resolutions at a vertical refresh rate of 75Hz were pretty easy on the eyes. The digital controls were quite user friendly as well with a pair of buttons for immediate contrast and brightness selection without having to navigate an OSD. The remainder of the monitor functions are called up with an OSD button and navigated via a rotary knob.

Performance was on par with the other four TNT-graphics-card-equipped systems. The high-end disk, graphics and Winstone performance were all a shade below average, but this would not be discernable in day-to-day use.

Dell Dimension XPS T500. Price (as tested): $5098. Dell Computer Australia. Ph: 1800 808 312. Fax: 02 9930 3311. www.dell.com.au

Digital Star Computers

Digital Star PIII 500

A structurally sturdy and well-machined case is not all that differentiates the midi tower Digital Star from your run-of-the-mill Aussie assembled systems. Digital Star decided to forgo the mandatory PS/2 mouse in favour of a scrolling Log-

Digital Star PIII 500

itech USB mouse, the first we have seen at the Lab. But what we found most interesting was the Logitech Internet keyboard that shipped with the system. A double row of buttons above and a single row to the right of the numeric keypad streamline your Internet access considerably by providing shortcuts to functions such as Search, History, Back, Forward and scroll up and down to name but a few. This saves quite a few of those frequent excursions from the keyboard to the mouse when navigating the Web.

Expandability is average for its class with six drive bays in total and the ability to access CPUs up to 550MHz. An extra DIMM slot lifts the maximum RAM up from the norm of 768MB to a full 1GB. And, should you feel the desire to stuff the case chock full of RAM, cards and mass storage the large cooling fan mounted at the front of the case is a very welcome addition.

It's a shame that the Sound Blaster Live is effectively hobbled by being mated with some rather mediocre Jazz speakers. In the past we have tested some quite acceptable speakers from Jazz but the two surround sound units supplied with this system downgrade the Live's sound quality.

The Videocom 17in monitor supplied is a good middle-of-the road performer. If we were to be hypercritical, we could say that the illumination is a tad uneven across the screen on a white background, but this is really nitpicking—the image quality is more than acceptable. The digital controls are relatively easy to use with four buttons: one for OSD activation, one for menu item selection and the final pair for adjustment.

The system was the strongest in the disk and graphics tests and the weakest in the FPU test, but in all cases the deviation was at most a couple of percent—undetectable in day-to-day use.

Digital Star PIII 500. Price (as tested): $4180. Digital Star Computers. Ph: 1800 800 628. Fax: 02 9737 9326. www.digitalstar .com.au

Elite Computer Systems

Elite PIII 500

Due to a miscommunication, which was no fault of the vendor, Elite's system was provided in a server configuration rather than a workstation configuration. As such it would be very unfair to compare this system directly with the other workstations supplied. Sadly, we had dismantled our Xeon server test network from the previous month as we are in the process of building a higher capacity test network for future *PC Magazine Australia* tests. So given the lack of test network and also the limited time to test in a network environment we had no option but to test the unit as a workstation. The supplied G100 card, fine for a server or the average business PC, was a tad outgunned by the TNT cards but, as you will see, "what you lose on the roundabout you gain on the swings".

The enormous case leaves no doubt as to the Elite's server heritage, it's the height of a good sized midi tower but over twice the width. The case is robust and provides very easy access with both sides able to be removed. The system is fitted with four lockable casters. Amongst this group at least, the Elite is the pinnacle of expandability with no less than eleven 5.25in drive bays and six 3.5in bays. The Chaintech motherboard accommodates up to 1GB of RAM and has dual CPU slots that can theoretically cater for a CPU with a 133MHz front side bus and an 8 times multiplier. (With a bit of simple math, we worked out that technically it was possible to have yourself a pair of 1.064GHz processors—our system had a more down-to-earth configuration of a single PIII-500.)

The motherboard had an embedded Adaptec Ultra2 SCSI controller that Elite chose to mate with a 9GB IBM 39130D drive, this would leave the other systems EIDE drives in the dust in a server environment but is soundly outperformed in the more mundane workstation scenario. Located in front of one of the PCI slots is a RAID slot to accompany an optional RAID daughterboard that works in conjunction with the onboard Adaptec controller.

Reliability is obviously a big concern at Elite, and rightly so if you set out to build a server. The case includes five large cooling fans, with mounting positions for several more if needed, and a pair of 300Watt hot-swappable power supplies.

The monitor supplied is nothing to get overly excited about: it's a simple 15in Samsung unit with a good quality display, but it is obviously not on par with larger units supplied with the other system. But then again in a server environment this would more than suffice.

We tested the system under the OS provided by the vendor, NT. This naturally gives the system an unfair advantage, NT is far more efficient running your apps than Windows 98. As a consequence, even with the G100 graphics card, the Elite blitzed the competition in Winstone, by almost four points in some cases. CPU performance was also the strongest of any system tested, although here the difference was minimal. It was in the graphics tests that the Elite fell down, but as you can see this did not effect the overall performance much at all.

Elite PIII 500

Elite PIII 500. Price (as tested): $5917. Elite Computer Systems. Ph: 02 9898 0222, Fax: 02 9898 1053. www.eliteindustries.com.au

EXTENDING THE PENTIUM III

What sets the Pentium III apart from the Pentium II (aside from higher clock speeds and different mechanical packaging) is the new Streaming SIMD Extensions (SSE). Formerly called Katmai New Instructions (KNI), SSE provides an instruction set and microarchitectural extensions that will improve the performance of certain applications using SSE features, particularly those that are floating-point-intensive.

SSE can benefit 3D graphics (especially lighting, transformation functions, and 3D game physics), 2D imaging, speech recognition, MPEG-2 encoding, scientific and engineering applications, and even some database applications. Mainstream productivity applications will show little improvement (see our benchmark test results).

Many mainstream users will benefit from SSE acceleration—both in Direct3D games that use DirectX 6.1 with SSE-enabled transform and lighting engines and in those games that include their own transform and lighting engines with SSE code. We also expect many graphics board drivers to use SSE's streaming instructions to move triangle data to and from memory.

The 3DNow! instruction set, developed by AMD, Cyrix, and others, was released last year in AMD's K6-2 and provides a subset of SSE capabilities. Intel chose not to participate in its development. Until the final SSE details are released, we'll avoid direct comparisons of SSE and 3DNow!

KEY SPECIFICATIONS

SSE provides four principal enhancements. There are eight new directly addressable 128-bit floating-point registers (which is the first true extension to the x86 register set since the 80386 was released in 1985), 50 new instructions designed for SIMD (Single Instruction, Multiple Data) floating-point operations, eight new instructions focused on streaming data to and from memory more efficiently, and 12 new MMX-class SIMD integer instructions called New Media Instructions.

THE NITTY GRITTY

The Pentium III SIMD capability allows four 32-bit single-precision floating-point values to be packed into a 128-bit register. A single SSE instruction would operate on two such registers, performing four simultaneous floating-point calculations. Unlike MMX, SSE permits concurrent execution of both MMX and SSE instructions, and concurrent execution of standard floating-point and SSE instructions. SSE registers are also directly addressable, with no stack bottleneck, unlike standard x86 floating-point registers.

The memory-streaming instructions enable memory prefetching, streaming stores, and enhanced write-combining. Prefetching permits cache line-sized data elements to be fetched from memory into the CPU, under application control, slightly before they are actually needed, with cache placement control. This helps hide memory latencies. The Pentium III external bus (essentially the same design as in the Pentium Pro and Pentium II) is designed to handle multiple outstanding pipelined bus transactions and enhances the performance of prefetch operations.

Streaming stores let the processor write streaming data (that typically won't be reused, like audio and video streams) directly to memory, bypassing all cache levels—thus preventing cache pollution (where frequently used instructions or data stored in cache are overwritten by far less critical data). Write combining allows multiple partial writes to successive memory locations to be combined into a larger single cache line-sized burst write operation in the write buffers. This improves throughput, particularly when used in combination with the Pentium III's bus pipelining. Intel has measured the Pentium III's write-combining bandwidth at 790 MBps, which is close to the theoretical maximum of 800 MBps for its 100MHz bus.

The New Media Instructions (integer SIMD) use MMX 64-bit registers and have new instructions that can improve performance of algorithms like motion estimation in software MPEG-2 encoders or aid word- and phoneme-probability matrix calculations in speech recognition software. Streaming stores for SIMD integer operations and conversion from SIMD integer to SIMD floating-point ability have also been added. *—Nick Stam*

Gateway

Gateway G7-500

Over the few short years the brand has been available in Australia, Gateway has gained a good reputation at the Lab for producing quality PCs a cut above the average Aussie-assembled clone, but unlike other big name vendors it still manages to instill some fire into the system's belly.

The midi tower case is quite attractive and relatively sturdy, but perhaps not quite as tough and well machined as some past examples of Gateway's craft. The vendor's trademark cooling system is still evident: the cowled cooling fan is external and slung just below the power supply case. This has the added advantage of drawing heat off the CPU, which otherwise only has a passive heatsink, and the remainder of the motherboard before blowing the warm air mix through the power supply and on to the outside world. This appears to work well and there does not appear to be any danger of the power supply overheating because of the added thermal load as all the exhaust air remains quite cool.

Three 5.25in and five 3.5in drive bays is quite an impressive quota for a midi tower case which is tidy and offers easy access to all components. The motherboard, with three DIMM slots caters for the usual 768MB of SDRAM but the manual claims the board only supports 100MHz bus speeds and multipliers for up to 500MHz processors such as the current incumbent PIII. As the CPU speed is software selec-

Gateway G7-500

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SUMMARY OF FEATURES

Pentium III PCs

Computer model	Digital Star PIII 500	Dimension XPS T500	Elite PIII 500 System
Distributor	Digital Star Computers	Dell	Elite Computer Industries
Price (incl. tax)	$4180	$4209 standard / $5098 as tested	$5617 - Win98; $5917 - WinNT
Address	8/ 191 Parramatta Road Auburn 2144	Building 3, 14 Aquatic Drive Frenchs Forest 2086	22-24 Bridge Street Rydalmere 2116
Phone/Fax	02 9737 9321/02 9737 9326	02 9930 3457/02 9930 3311	02 9898 0222/02 9898 0225
Web site	www.digitalstar.com.au	www.dell.com	www.eliteindustries.com.au
Warranty	2 years parts, 5 years labour	Dell SelectCare	3 Years RTB
Processor type & speed	Intel PIII 500	Intel PIII 500	Intel PIII 500
Motherboard name & revision	Gigabyte GA686BXE / 2.6	Intel Seattle III/	Chaintech CT-6BDV /
Motherboard bus speed in Mhz	66, 100	100	100, 103, 112, 133
Multiplier support	x3, x3.5, x4, x4.5, x5, x5.5	x3, x3.5, x4, x4.5, x5	x2, x2.5, x3, x3.5, x4, x4.5, x5, x5.5, x6, x6.5, x7, x7.5, x8
Chipset name and manufacturer	Intel 440BX	Intel 440BX	Intel 440BX
BIOS Name and Version	Award Modular v4.51PG/	Pheonix/ 6.0	Award Modular v4.51PG/
Power supply (watts)	250	200	2x300
Mains passthrough	No	No	No
Drive bays (total/free)	3x5.25/ 2, 2x3.5/ 1	2x5.25/ 1, 3x3.5/ 2	11x5.25/ 9, 6x3.5/ 5
Hard disk manufacturer and model	IBM DTTA-371010	IBM DTTA-371290	IBM DDRS-39130D
Hard drive capacity in GB	10.1	12.9	9
Hard drive interface and modes supported	IDE	IDE	Ultra2-LVD SCSI, UltraWide SCSI, NarrowSCSI, IDE
Total system RAM (test configuration)	128	128	128
Max system RAM	1GB	768	1GB
DIMM (total/free)	4/3	3/2	4/3
RAM type/ speed	SDRAM/ PC100	SDRAM/ PC100	SDRAM/ PC100
Secondary RAM Cache	512KB	512KB	512KB
Bus Expansion slots (total)	1xAGP, 5xPCI, 2xISA, 1xShared	1xAGP, 5xPCI, 1xISA, 1xShared	1xAGP, 4xPCI, 2xISA
Expansion slots free	4xPCI, 2xISA, 1xShared	2xPCI, 1xISA, 1xShared	3xPCI, 2xISA
Ports S,P,USB,G,P/S2	2,1,2,2,2	1,1,2,1,2	2,1,2,0,2
Keyboard type and interface	Logitech Internet, PS/2	Dell, PS/2	Acer, PS/2
Mouse type and interface	Logitech, USB	Logitech, PS/2	Microsoft, PS/2
Video card manufacturer and model	STB Velocity 4400	STB Velocity 4400	Matrox Prodcutiva G100
Bus type	AGP	AGP	AGP
Video processor manufacturer and model	nVidia RIVA TNT	nVidia RIVA TNT	Martox G100
Video memory (fitted/maximum) /type	16MB/ 16MB/ SDRAM	16MB/ 16MB/ SDRAM	8MB/, 8MB/ SGRAM
Monitor (brand & model)	Videocom DC-770LAT	Phillips D1226H	Samsung Syncmaster 510s
Rated screen size/viewable in inches	17, 16	19, 17.9	15, 13.9
Dot pitch (mm)	0.25	0.26	0.28
Maximum resolution	1280x1024	1600x1200	1024x768
Horizontal frequency range (Khz)	30-70	30-95	30-61
Vertical frequency range (Hz)	50-120	50-160	50-120
CD-ROM manufaturer & model	LG CRD-8400B	Toshiba SD-M1202 DVD-ROM with card	Sony CDU625
Interface	IDE	IDE	SCSI
Speed	40x	4.8x - DVD, 32x CD	24x
Sound card manufacturer & model	Creative Sound Blaster Live	Turtle Beach Montego A3D	Not Supplied
Interface Bus (Eg PCI)	PCI	PCI	N/A
Internal Connectors	Aux, CD, TAD	CD,	N/A
External Connectors	Line in/ out front, Line out rear, games	Line in/ out, mic, games	N/A
No. of Hardware Voices	64	128	N/A
3D Audio Support (Eg Direct3D)	DirectSound3D, Creative Audio 3D	DirectSound3D, A3D	N/A
Wavetable Sound sample size	2MB, 4MB, 8MB	4MB	N/A
Speakers supplied (model)	300W Jazz 3D 2 speaker	Altec Lansing ADA-880 4.1 with remote control	No
Other Hardware options fitted	—	US Robotics 56K/V.90 data/fax/voice modem	Intel EtherExpress Pro 10/100+ networkcard
Software supplied	Win98	Win98, DVD Title Sphere, IE4.01, McAfeeVirus Scan	AirBag 0.1, 7800 Family Manager 3.0

500MHz Pentium III PCs

Gateway G7-500	Persica 3000	Pioneer 2000 PIII 500	Ultra PIII Office
	PC MAGAZINE AUSTRALIA EDITOR'S CHOICE		
Gateway	Zylax Computers	Pioneer Computers	Total Peripherals Group
$4397	$3295	$3995	$5150 - Win 98, $6495 - NT Server and 5 clients
6-10 Talavera Road	Unit 1, 4 Prince William Drive	Unit 17, 21 Bowden Street	65 Waterloo Road
North Ryde 2113	Seven Hills 2147	Alexandria 2015	North Ryde 2113
1800 500 916 / 02 9966 1754	02 9674 8177 / 02 9674 8166"	02 9690 2888 / 02 9690 0333	02 9850 0839 / 02 9878 5637
www.gw2k.com.au	www.zylax.com.au	www.pioneercomputers.com.au	www.tpg.com.au
2 years parts, 1 year on-site	1 year on-site/ 3 years limited RTB	2 years parts, 5 years labour	3 years on-site metro
Intel PIII 500	Intel PIII 500	Intel PIII 500	Intel PIII 500
Intel BX	FIC VB-601/ A5	SuperO P6SBA /	Asus P2B-S / 1008
100	66, 75, 83, 100, 112, 124, 133	66, 100	50, 66, 75, 83, 100, 103, 112
x3, x3.5, x4, x4.5, x5	x3, x3.5, x4, x4.5, x5, x5.5	x3, x3.5, x4, x4.5, x5, x5.5, x6	x2, x2.5, x3, x3.5, x4, x4.5, x5, x5.5, x6
Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX
Pheonix/ 6.0	Award Modular v4.51PG/ MI411	AMIBIOS	Award Modular v4.51PG/
200	250	250	250
No	Yes	No	Yes
3x5.25/ 2, 2x3.5/ 1	3x5.25/ 2, 1x3.5/ 0	3x5.25/ 2, 3x3.5/2	3x5.25/ 2, 2x3.5/ 1
IBM DTTA-371440	Seagate Medalist 10240	IBM DTTA 371010	Seagate Barracuda
14.4	10.2	10.2	9.1
IDE	IDE	IDE	Ultra2-LVD SCSI, Ultra DMA/33, IDE
128	128	128	128
768	1GB	768	1GB
3/2	4/3	3/2	4/ 3
SDRAM/ PC100	SDRAM/ PC100	SDRAM/ PC100	SDRAM/ PC100
512KB	512KB	512KB	512KB
1xAGP, 5xPCI, 1xISA, 1xShared	1xAGP, 5xPCI, 2xISA, 1xShared	1xAGP, 4xPCI, 3xISA, 1xShared	1xAGP, 4xPCI, 2xISA, 1xShared
4xPCI, 1xISA, 1xShared	4xPCI, 2xISA, 1xShared	2xPCI, 3xISA, 1xShared	3xPCI, 2xISA, 1xShared
2,1,2,2,2	2,1,2,0,2	2,1,2,1,2	2,1,2,0,2
Gateway, PS/2	Leo Internet, P/S2	Mitsubishi Diamond Touch, PS/2	Mitsubishi Diamond Touch, PS/2
Microsoft, PS/2	Leo, PS/2	Logitech, PS/2	Microsoft, PS/2
STB Velocity 4400	Diamond Viper 550	Diamond Viper 550	S3 Trio 3D
AGP	AGP	AGP	AGP
nVidia RIVA TNT	nVidia RIVA TNT	Nvidia RIVA TNT	S3 Trio
16MB/ 16MB/ SDRAM	16MB/ 16MB/ SDRAM	16MB/ 16MB/ SDRAM	4MB/ 4 MB/ SDRAM
Gateway VX700	Leo BM17N	Mitsubishi Diamond View 1772e	TPG 1569SE
17, 15.9	17, 15.9	17, 15.9	15, 13.8
0.26	0.27	0.27	0.28
1600x1200	1280x1024	1280x1024	1280x1024
30-86	30-70	30-72	30-70
50-130	50-160	50-120	50-120
Toshiba SD-M1202 DVD-ROM	LG CRD-8400B	Hitachi DVD-ROM GD2500	Mitsubishi Diamond Data
IDE	IDE	IDE	IDE
4.8x - DVD, 32x CD	40x	6x - DVD, - CD	36x
Creative Sound Blaster PCI64	Sound Blaster PCI64	Creative Sound Blaster Live	Not Supplied
PCI - on board	PCI	PCI	N/A
CD,	CD	Aux, CD, TAD	N/A
Line in/ out, mic, games	Line in/ out, mic, games	Line in/ out front, Line out rear, games	N/A
64	64	64	N/A
DirectSound3D	DirectSound3D	DirectSound3D, Creative Audio 3D	N/A
2MB, 4MB, 8MB	2MB, 4MB, 8MB	2MB, 4MB, 8MB	N/A
Boston Acoustic Digital Media Theatre 2.1	Juster 3D-103 2 speaker with subwoofer	Cambridge Soundworks 4.1	No
56K internal data/fax modem	Web Excel 56K external fax/modem	N/A	Intel EtherExpress Pro 10/100+ network card
Telstra Bigpond 100 hours bonus internet access	Win98, Lotus SmartSuite	Windows 98, Creative application, NortonAnti-Virus - Norton Virtual Drive Supermicro doctor 1.31, DMI Browser	Windows NT Server+H51

table we figure it may, with a simple BIOS upgrade, be able to support higher multipliers but as and we did not have a faster CPU than 500MHz we could not check this aspect out.

Sound quality was very good with an embedded Creative Sound Blaster PCI64 driving a set of Boston Acoustics Digital Media Theatre speakers. The Boston Acoustics consist of large subwoofer and a pair of small, but surprisingly mellow, satellite speakers—in this configuration they supply Virtual Dolby Surround sound. However, if you add a pair of optional rear satellite speakers the system provides full Dolby Surround. A DVD rather than a CD-ROM drive is supplied but without the support of a DVD decoder board.

"Above average" about sums up the 17in monitor supplied with the system. The display was sharp with good colour and even illumination and, in a fit of over-embellishment, the monitor's designer endowed it with a soft eject drop-down digital control panel. The extensive OSD menu is very easy to navigate with the four selection buttons, two adjustment buttons and a dedicated degauss.

In terms of performance, the TNT-equipped Gateway was just as quick as all the other similarly configured systems although perhaps a tad faster than average in the graphics tests and a bit slower than average in the disk throughput tests. However, differences in application performance would not be noticeable. The Gateway is certainly worth considering, it is the least expensive of the big brand names and does include a modem, quality speakers and monitor in its very reasonable price tag.

Gateway G7-500. Price (as tested): $4397. Gateway Australia. Ph: 1800 500 916, Fax: 02 9966 1754. www.gw2k.com.au

Zylax Computers

Persica 3000

Zylax Computers is not a name we have known for long but when we caught the incredibly low price of this system we certainly paid it some close attention. The computer brand is actually Leo (even the power supply is actually branded with this moniker). The case is quite sturdy and although internally its machine finish is not quite as flash as some, it is still well constructed, and the front fascia with its gentle curves is actually quite attractive. A large cooling fan is also mounted in the front of the case; however, with only two asthetically pleasing, but rather puny, vent holes in the front facia, airflow is not tremendous (though every little bit helps).

The system shipped with six drive bays but there does appear to be mounting points on the power supply for an optional 3.5in bay as well. The system can be upgraded to a full 1GB of SDRAM and the motherboard supplies a wealth of clock speeds from 66MHz right up to 133MHz which, when coupled to the 5.5 multiplier, comes in at just under 700MHz.

Audio is quite good. The Sound Blaster PCI64, while not the best available, still provides a good midi and gaming experience. The supplied Juster speakers are adequate and even with the supplied sub woofer the sound is a bit thin and the bass is booming rather than mellow. For listening to your favourite CD or midi file we would certainly be looking for better, but for the average game they acquit themselves well.

Although not as rugged and full featured as Digital Star's Logitech Web keyboard, the Leo keyboard nevertheless has some useful features. A special "EX" button above the numeric keypad activates additional functions on the twelve function keys ranging from volume control and CD playback to Web access. Another bonus is the bundled OEM Lotus Smartsuite, saving the average punter several hundred dollars buying an office suite.

While the 17in Leo monitor may not dazzle you with its brilliance and is not the best amongst its peers, it nevertheless gets the job done with acceptably sharp display, good colour saturation and reasonably even illumination. The digital controls, in conjunction with the simple OSD, are quite user-friendly and provide a good range of adjustments including colour balance.

We admit the performance was close amongst these systems but the only benchmark that this system did not score above average on was price.

Persica 3000. Price (as tested): $3295. Zylax Computers. Ph: 02 9674 8166, Fax: 02 9674 8177. www.zylax.com.au

Pioneer Computers

Pioneer 2000 PIII 500

In the rarefied field of PIIIs, the Pioneer's sub $4000 price tag represents quite good value for money given its healthy feature set. The system includes a DVD drive rather than a cheaper CD-ROM drive although it does not include a DVD decoder board. Admittedly the midi tower case does not look particularly special, but it is solid and well built with no nasty sharp edges to draw blood from the unwary. The case includes a robust locking tab to discourage pilfering or unauthorised tinkering and our fully configured system still had three free drive bays. The case also included a cooling fan in the lower front fascia, not that it really needed it as the internal temperature remained very low even with-

TPG Ultra PIII Office

out the fan's help. But then if some techno-junkie stuffs the system with cards and hard drives it may come in handy. The motherboard was a quality SuperO, American designed and featuring a very small footprint with good expansion capabilities; the manual boasts CPU speeds up to 600MHz and the ability to up the memory to 768MB of SDRAM.

Audio was provided by one of the Lab's favourite sound cards: the Creative Sound Blaster Live! (complete with the Cambridge five-speaker surround sound kit) so sound quality was very good. To be honest the only slight weak link is the speaker system—impressive for its size but no match for the Dell's Altec Lansing setup. The 17in Diamond View monitor supplied with the system had a sharp image and good colour saturation and although the controls were totally digital and screen menu based the four navigation buttons and simple menu were easier to use than many other monitors. The Pioneer is a well-balanced system with solid performance in all the tests, in most cases bang on average for its peer group.

Pioneer 2000 PIII 500. Price (as tested): $3995. Pioneer Computer. Ph: 02 9690 2888. Fax: 02 9690 0333. www.pioneercomputers.com.au

Total Peripherals Group

TPG Ultra PIII Office

TPG (in response to the same miscommunication that confused Elite) also provided a system more in line with a server configuration than a workstation. The case alone does not distinguish the TPG's server ancestry, it's a pretty standard midi tower with regards to both build quality and features. There is a large cooling fan at the front to provide enough airflow should the case become crammed with cards and mass storage, and speaking of the latter, seven drive bays is fine for a workstation but in all but the lowest-end server application you could be found wanting more space.

The ASUS motherboard has a very large footprint, and although it only sports a single processor it does have an embedded Adaptec Ultra SCSI2 controller which is driving a 9GB Seagate Barracuda hard drive and RAM is expandable to the full 1GB. As you would expect of a server, the system does not include a sound card or speakers and shipped with a low-end 15in monitor. The monitor's display quality was average for its class, certainly overshadowed by the 17in and above monitors provided with most of the other systems under test. Four adjustment buttons provide brightness and contrast functions until the colour or geometry OSD is activated. At this point they adjust the broad range of functions that includes colour balance and rotation.

Thankfully the system was shipped with Windows 98 loaded, not NT, as a consequence the test results are more comparable than in the case of the Elite. The systems CPU and FPU performance was very strong but again the gap between the slower systems was struggling to amount to a couple of percent. The S3 Trio 3D based graphics card is well out of the race in a workstation environment and in 2D its 24 or 32-bit performance is quite weak. Understandably, in our Winstone tests the TPG faired well at 16-bit but at higher resolutions and colour depths the application throughput was degraded by the slow card. We have reason to believe that this system would perform at least as well as the other systems if fitted with an identical TNT card. Unfortunately our very tight test schedule and the late arrival of this system did not allow us time to tinker.

TPG Ultra PIII Office. Price (as tested): $5150. Total Peripherals Group. Ph: 02 9850 0800. Fax: 02 9878 3877. www.tpg.com.au ■

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SOFTWARE RETURNS TO ITS SOURCE

In the pre-Microsoft days, software and the code behind it were freely distributed. Thanks to the Internet, open-source software is experiencing a rebirth. This time, programmers are not the only ones taking notice. **By Larry Seltzer**

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Although it sounds like something you'd have to wear a pocket protector to care about, open-source software suddenly has become a very hot topic. Aided in large part by the growth of the Internet, open-source software has quietly assumed a pivotal role behind workaday tasks such as Web browsing and e-mail. Software makers are lining up to support Linux, an open-source operating system. And customers are realising there just may be something to the concept. All of which means that you can expect to see a lot more of open-source software.

Although it is often confused with freeware, open-source software is fundamentally different from all forms of commercial software. In a nutshell, open-source software is software that, in addition to the executable files, comes with the source code, the set of instructions the developer wrote to create the program. In most cases, both the executables and source code are available free of charge on the Internet. Furthermore, anyone can modify and even redistribute these programs.

What kind of software is open-source? Well for starters, the Internet runs on open-

The Free World of Software

The open-source movement is based on the notion that hundreds or thousands of individual programmers working in tandem can produce software better and faster than a smaller, focused development team within one company.

License

Like any other kind of software, open-source software is governed by a license. But while most software licenses tell you only how you can use a program, an open-source license ensures that you can actually alter the program by tinkering with its code, and distribute the results of your work.

The most common license is the General Public License (GPL), also known as copyleft. From a commercial standpoint, the GPL is the most restrictive open-source license. Anyone can modify a GPL program, but the resulting work must also be made open-source under the GPL. The Linux operating system is protected by this kind of license.

At the opposite end of the spectrum is the BSD license, the model created initially for a version of Unix known as the Berkeley Software Distribution. Essentially, the license places no restrictions on developers. Anyone can modify the program and redistribute it for a fee without being required to give anything back. The FreeBSD operating system and Apache Web server are distributed under BSD licenses.

Official Releases

Although the development of an open-source program is continual, the individual or group that is responsible for it periodically takes a snapshot of the code when major new features have been implemented, then compiles it for distribution as an official release. Developer Linus Torvalds recently released the long-awaited Version 2.2.0 of the Linux kernel, the core component of the operating system.

www.APACHE.ORG

www.LINUX.ORG

www.MOZILLA.ORG

Open-Source Software.org

Although no one owns an open-source product in the traditional sense, most open-source projects are shepherded by core groups of developers, usually dispersed around the globe. Without the Internet, open-source software wouldn't exist today. Sites such as Linux Online, The Apache Group, and Mozilla.org provide a central location from which developers can download source code, report bugs, submit bug fixes and patches that add new features, post messages on newsgroups, and more.

Hackers

Most developers who work on open-source software are volunteers who hack in their spare time. Some are graduate students or hobbyists. Others are out to impress their peers with their programming prowess. Still others seek to create derivative products that they can turn around and sell. Developers may fix documented bugs, search for new bugs, add new features, or even rewrite entire portions of a program. Once they've finished a task, they return the code to the module owner—although not all licenses require this step.

Modules and Module Owners

The first version of Linux, released in 1991, contained around 10,000 lines of code. Today, it consists of well over 1 million lines of code. To make an open-source project manageable, the author or group that oversees it usually divvies it up into separate components or modules. Each module has an owner, who oversees that portion of the code. Module owners, who are volunteers, ensure that the goals for the project are being met, and they review the patches and bug fixes other developers have posted to determine which ones should be added to the code and which discarded.

GRAPHIC BY MARK TYNER

MILESTONES IN THE OPEN-SOURCE MOVEMENT

1968 ARPANET, the Internet's precursor, is founded in the US. Although ARPANET is designed to allow researchers to share code and information on projects, it also becomes a showcase for the abilities of open-source software.

1969 Ken Thompson, a researcher at Bell Labs in the US, writes the first version of Unix, a multiuser, multitasking operating system. The Unix source code is distributed freely throughout the seventies, and it soon becomes popular at universities and research labs.

1971 Richard Stallman, a pioneer in the open-source movement, joins an MIT group devoted exclusively to free software. The developer of the first Emacs text editor, Stallman later founds the GNU project (short for GNU's Not Unix), this leads to the creation of a free, Linux-based operating system.

1973 Vinton Cerf and Bob Kahn from America's DARPA (Defense Advanced Research Projects Agency) develops the TCP/IP protocol—which becomes the networking foundation of the Internet. A decade later, the US Department of Defense christens the Internet and mandates that all computers attached to the Internet use TCP/IP.

1979 AT&T announces plans to commercialise Unix. This leads the University of California at Berkeley to create its own version of Unix, called BSD (Berkeley Software Distributions) Unix. BSD Unix is adopted by early commercial vendors such as DEC and Sun. AT&T and Sun later agree to merge their versions of Unix, prompting competitors (DEC, HP, and IBM) to form the Open Software Foundation.

• A student at the University of California at Berkeley, Eric Allman, develops a program to route messages between computers over ARPANET. Allman later evolves the program into sendmail. Today, more than 75 percent of Internet e-mail servers use this open-source program to deliver mail.

1983 In a reaction to the proprietary trend in software, Stallman establishes the GNU project to promote the free-software model by developing a free operating system, applications, and programming tools. More important, GNU establishes the General Public License (GPL), better known as a copyleft, which becomes the model for many subsequent open-source projects.

source software to a large extent. DNS (Domain Name System)—the system that associates names like *www.zdnet.com.au* with numerical IP addresses—and sendmail, the postal service of the Internet, are both open-source projects. Yahoo!, arguably the most successful Web site in the world, relies on an open-source OS (FreeBSD) and open-source Web server software (Apache) using an open-source scripting language (Perl) to deliver dynamic content to desktops. In fact, before Microsoft came along and created the personal computing industry, much of the world's software was passed around freely among developers.

Recently, there have been signs of a renaissance in open-source. Linux, the little open-source operating system that could, has quietly stolen a significant chunk of the Unix market and, if it isn't threatening to derail Windows NT, is at least becoming a distraction for Microsoft. In the last year, several major software companies, including Corel, Oracle, and Sybase, have announced plans to port products to Linux (pronounced "lynn-icks"). Others, such as Netscape Communications and Sun Microsystems, have taken it a step further and adopted the open-source model for their own products.

To see what all the excitement is about, we decided to take a closer look at the open-source phenomenon and some of the products that are coming out of it, both on the server side and the desktop. We discovered that there is still a lot of work to be done before open-source software will be ready to vie for a piece of the desktop. On the other hand, open-source software (especially Linux) is becoming a serious competitor on the back end, where power takes precedence over ease of use.

In the pages that follow, we explain how open-source stays open, identify key projects, analyse who's using this software,

PC MAGAZINE AUSTRALIA EDITORS' HOT LINKS

More than any other type of software, open-source relies on the Internet, and vice-versa. Here are some key destinations.

Open Source Initiative
www.opensource.org
A relative newcomer, this independent organisation was created a year ago to broaden the open-source movement. Here you'll find an "official" definition of open-source software and links to important projects.

Everything Linux
www.everythinglinux.com.au
A sales-oriented site offering books, Linux distributions, merchandise and other software of interest to the open-source community.

Open Source Projects at Apple
www.publicsource.apple.com
Apple is the first major computer company to make Open Source development a key part of its ongoing software strategy—this site keeps you up to date.

O'Reilly Open Source Center
opensource.oreilly.com
O'Reilly and Associates specialises in books about open-source software. The Open Source Center includes news and links to notable open-source projects.

Free Software Foundation
www.fsf.org
The organisation behind the GNU Project, which led to the creation of many of the leading open-source tools. The Free Software Foundation's Web site provides information on open-source projects, documentation, and source code.

Linux Online
www.linux.org
For information on Linux, look no further than this site. Linux Online is a repository of information on everything Linux, ranging from information on projects and various distributions to news articles.

The Linux Kernel Archives
www.kernel.org
Serving as the official source for the Linux kernel, these archives include a vast library of Linux-related software. The first place to look for Linux downloads.

Mozilla.org
www.mozilla.org
Home to Netscape's open-source effort, Mozilla is responsible for future developments of Communicator. The site features the source code, documentation, and a preview release of the browser.

The Apache Project
www.apache.org
The official site of the Apache Web Server Project. This site includes product documentation, a bug-reporting system, project-related information, and the downloadable source code.

SLUG
www.slug.org.au
The Sydney Linux User Group (SLUG) provides a forum for Australians to come and discuss Linux issues. It also provides information on periodic meetings held in Sydney.

The Linux Documentation Project
metalab.unc.edu/LDP
The Documentation Project is filling in the gaps in customer support by developing an extensive database of online help, including installation and user guides, and much more.

1986 Larry Wall creates Perl (Practical Extraction and Report Language), a versatile programming language used for writing CGI (Common Gateway Interface) scripts, which are the standard means of delivering more dynamic content on the Web today.

1987 Developer Andrew Tanenbaum releases Minix, a version of Unix for the PC, Mac, Amiga, and Atari ST. It comes with complete source code.

1989 Aiming to exceed the capabilities of Minix, a young student at the University of Helsinki, Linus Torvalds, releases a new Unix variant, Linux. Three years later, Torvalds copylefts Linux. Today, there are an estimated seven million Linux users, according to Red Hat Software

1993 FreeBSD 1.0 is released. Based on BSD Unix, FreeBSD includes networking, virtual memory, task switching, and large filenames. The BSD license does not require developers to give anything back

1994 Marc Ewing forms Red Hat Linux to address Linux's ease-of-use problems. Red Hat packages Linux

with third-party applications, documentation, and initial technical support and sells it for about US$50. Red Hat quickly becomes the leading Linux distributor. The same year, Bryan Sparks founds Caldera with backing by former Novell CEO Ray Noorda.

1995 The Apache Group builds a new Web server, Apache, based on the

National Center for Supercomputing Applications' (NCSA's) HTTPd 1.3 and a series of patch files. The free Web server becomes one of the most popular HTTP servers.

1997 Eric S. Raymond, programmer and author of **The New Hacker's Dictionary**, delivers a paper titled "The Cathedral and the Bazaar", contrasting commercial and open-source development models, at Linux Kongres. The paper becomes the inspiration for Netscape's Mozilla.org.

1998 Netscape announces it will not only give away Communicator 5.0 but will also release its source code

- Bruce Perens and Raymond (formerly with Debian Linux) establish the Open Source Initiative and apply for a trademark on Open-Source.
- Major software vendors, including, Computer Associates, Corel, IBM, Informix, Interbase, Oracle, and Sybase, announce plans to port their products to Linux
- Mired in a landmark antitrust case, Microsoft issues a statement citing Linux as evidence that the company does not have a monopoly on operating systems. Shortly afterward, the Halloween documents—a series of internal Microsoft memoranda on the threats posed by open-source software and Linux—are leaked to the open-source community and posted on the Web
- Sun Microsystems announces plans to release the source code for Java 2 (formerly known as JDK 1.2) to developers, under a modified license

find out what Microsoft thinks about all this, and discuss who's making money from it. We also performed hands-on reviews of four popular Linux packages (Caldera OpenLinux 1.3, Debian GNU/Linux 2.1, Linux Slackware 3.6, and Official Red Hat Linux 5.2), the Apache Web server, and Netscape Gecko, the engine behind the next generation of Communicator.

The open-source movement didn't get serious until the early eighties, when an MIT researcher Richard Stallman established the GNU Project to create an open, free version of Unix. (GNU stands for *GNU's Not Unix*). GNU fell short of its goals, but the project yielded a host of important tools that were later merged with Linux to produce a full-featured OS. To protect the work, Stallman founded the Free Software Foundation (*www.fsf.org*) and drafted the General Public License (GPL) that Linux and many other projects operate under to this day.

Eric S. Raymond, the programmer behind many prominent open-source projects, fleshed out the open-source process in a well-known essay called "The Cathedral and the Bazaar". He argued that open-source produces better software because, with so many developers working on it simultaneously, new features are implemented more quickly and bugs are tracked down more effectively. These ideas were the inspiration behind Netscape's decision to release the Communicator source code.

Although most open-source projects have loose teams of developers that oversee them, commercial software companies that distribute open-source products also contribute to the cause. Both Caldera Systems and Red Hat Software have contributed some of their work on Linux.

It all sounds too good to be true: free software backed by credible companies, and you get the source code, too. Of course, there's no such thing as a free lunch, and open-source still has many barriers to overcome before it can attain mainstream success.

The biggest problem is that much of today's open-source programs are hard to use. Even experienced Windows users can find themselves hamstrung when Linux fails to recognise a network interface card, or when the X Window system (the basis for the graphical user interface, or *GUI*) isn't configured properly. Another major concern, especially in the corporate space, is support. No one really owns Linux, so who's to blame if something breaks? Finally, Linux simply doesn't have the same variety of sophisticated productivity applications that Windows users enjoy. Various open-source and commercial projects are addressing all these issues, but there's still a long way to go.

Why does open-source software matter to you? While you may not have any desire to mess around with source code, there are many reasons open-source can be an advantage for users. Developers can write quick patches that solve little problems. Companies can extend the functionality of their applications to meet specific objectives. And software makers can build on the code to create and sell new products and services. Finally, from a market standpoint, the existence of open-source means more competition in the software industry, and that is a good thing for all users.

OpenSource.Org

RATING TOP LINUX DISTRIBUTIONS

Unlike Microsoft Windows 98 or NT, the Linux operating system is not a single product. Instead, there are many distributions on the market, and not all are created equal.

All distributions share the same Linux kernel, which includes all the core OS functions and the network stack. In addition, they all provide the standard tools such as popular system libraries, a dizzying array of applications and utilities, some printed documentation, and limited technical support. Each distribution includes an X Window system and a graphical user interface (a must for Windows users), a Web server, e-mail servers, and an FTP server. The real differences lie in installation, system configuration, support, and third-party applications.

For example, installation can be arduous and the setup process often fails to recognise hardware such as network interface cards (NICs). Aside from a handful of graphical tools, most of the system and network configuration utilities have imposing command-line interfaces and demand some expertise. Customer support—at least in the formal sense—is limited. Finally, although each distribution comes with many applications, few are as sophisticated or as easy to use as Microsoft Office, for example. Nevertheless, if you're willing to invest a little time, you can get up and running. If you are just looking to get your feet wet, Red Hat is the best choice, largely because it has the most sophisticated setup of the group. Caldera's setup is not quite as smooth, but it includes many features that make it an attractive business solution for small to medium-size organisations.

To get an idea of how the leading Linux distributions stack up from the standpoint of a Windows user, we tested Caldera OpenLinux 1.3, Debian GNU/Linux 2.0, Linux Slackware 3.6, and the official Red Hat Linux 5.2. For a full list of distributions, see the Linux Distribution List (**www.everythinglinux.com.au**).

First, some general recommendations. You can either purchase any of the four distributions we look at here on CD-ROM, for prices ranging from $40 to $100, or download them free. The latter option may be tempting, but our strong advice is to spend the money. You'll want the included documentation, and more important, none of the vendors will provide technical support unless you pay to play. Also, before choosing a distribution, check the vendor's hardware compatibility list (often available on the Web site) to make sure all your devices are supported.

Finally, although each distribution includes some documentation, the best source for Linux support is the Internet. A good place to start is The Linux Documentation Project (**metalab.unc.edu/LDP**).

CALDERA OPENLINUX 1.3

Linux is not known as a corporate OS, but Caldera is trying to change that perception. Caldera OpenLinux 1.3 ($119) is the only distribution that includes a comprehensive set of business applications, including its own NetWare Client Software, a database server (Sybase ASE), and a full-featured productivity suite.

Like Red Hat (reviewed below), Caldera provides a boot disk, which makes installation easier. On the whole, Caldera's installation process is not as graphical or intuitive as Red Hat's, but aside from having to partition our drive using the crude fdisk utility, we found that the setup was not difficult and required little user intervention. Caldera includes Red Hat Package Manager (RPM), which makes it easy to install and uninstall packages—at least, by Linux standards. LISA (Linux Installation System Administration) is a graphical tool you use to configure basic network client parameters as well as other features. In practice, we wound up spending a lot of time editing configuration files manually.

One of Caldera's greatest strengths is KDE (Kool Desktop Environment), a graphical desktop environment that essentially makes Linux look and act like Windows. When you combine this with the bundled StarOffice 4.0, Star Division's clone of Microsoft Office, you have a complete solution for small and medium-size businesses right out of the box. A final advantage is that Caldera Systems offers a variety of support plans that include telephone as well as e-mail support.

Caldera OpenLinux 1.3. Price: 2-CD set, Linux kernel 2.0.36, boot disk, Getting Started Guide, 30 days e-mail technical support, $119. Requires: 386-based PC or better, 16MB RAM, 350MB hard disk space (450MB to use extra applications). Custom Technology; Ph: 02 9686 4055, Fax: 02 9686 4377, www.customtech.com.au

DEBIAN GNU/LINUX 2.0

Debian GNU/Linux 2.0 ($45) is the only major distribution that is still produced by a group of volunteer programmers. This, combined with its many powerful features, makes it a popular choice among hackers. But Windows users should steer clear of Debian.

For starters, Debian gets our vote for the most difficult installation. Although it does not come with a boot disk, you can either make one or, if your system allows, boot from the CD. The setup includes a version of fdisk (for making the required hard disk partitions) that is somewhat graphical but still not very easy to use. If you have a good handle on all the hardware inside your box and you know how to configure a network, the wizardlike install is tolerable. After completing the installation, we found that almost no applications were on the system. Applications such as the emacs text editor and the Web server must be installed separately with Debian's dselect utility, which is notoriously difficult to use. The company says it will include a new application installer in Debian GNU/Linux 2.1 (which should be available by the time you read this).

Once you get past the installation, Debian's included X Window helps make things a little easier. This distribution's biggest selling point is an alternative package manager, Debian Package Management System, which scans new applications prior to installation and checks your existing system configuration to ensure that you have the required packages and that no currently installed applications will cause a conflict. Debian is distributed by Linux Press, along with a 268-page user guide.

Debian GNU/Linux 2.0. Price: 3-CD set; Linux kernel 2.0.35; The Debian Linux User's Guide, Second Edition; 30 days e-mail technical support, $45. Requires: 386-based PC or better, 16MB RAM (for graphical interface), 100MB hard disk space minimum (200MB recommended). Distributed by Linux System Labs Australia; Ph: 03 9857 5918, Fax: 03 9857 8974, www.lsl.com.au or www.debian.org.au

LINUX SLACKWARE 3.6

Once the most popular Linux distribution, Patrick Volkerding's software has lost the market lead to the more-polished Red Hat but remains especially popular with hardcore Linux users. Like Debian, Linux

Slackware 3.6 does not include a boot floppy disk. And when you're creating one from a disk image, the many choices for different hardware configurations can be daunting. We finally found a generic disk image (bare.i) that worked fine.

The Slackware distribution is not nearly as easy to use as Caldera or Red Hat. But it has some good points. When we forgot to save some settings in a config script before rebooting during installation, Slackware automatically sent e-mail to the root user describing what had happened and how to recover. It also provides a good collection of powerful configuration scripts, which perform actions that would require several commands in other distributions.

One of the best features of Slackware is that it includes an installed version of Linux complete with X Window on a CD-ROM, so if you have a system that can boot to the CD-ROM drive, you can test-drive Linux without installing anything on your hard disk. Slackware includes a conversion tool for managing RPM packages and the FVWM95 window manager.

Linux Slackware 3.6. Price: 4-CD set, Linux kernel 2.0.36, installation guide, technical support, $33.95. Requires: 386-based PC or better, 8MB RAM, 200MB hard disk space (500MB for complete installation). Tesla; Fax: 03 9857 6974, www.tesla.net.au

OFFICIAL RED HAT LINUX 5.2

Official Red Hat Linux 5.2 ($74) has emerged as the most important player in the Linux market, because it offers by far the most polished setup and it also has an advanced package manager. If you're trying Linux for the first time, Red Hat is the best choice.

Like Caldera, Red Hat includes a boot floppy disk. The setup process conveniently probes your hardware, making logical suggestions for installation (laptop users will appreciate the PC Card support). Red Hat also makes the choice of partitioning a little easier by providing standard Workstation and Server installations, which partition your disk and choose software automatically. (To designate your own partitions, you can still choose the custom install.) For the actual partitioning, Red Hat gives you a more graphical tool called Disk Druid that is a major improvement over the fdisk utility included with the other distributions—although you'll still need to understand some basic concepts about partitioning and directory structures.

To make system configuration easier, Red Hat includes several tools. Xconfigurator is a wizard-like alternative to XF86Setup for configuring the X Window system. And Linuxconf makes it easier to set up networking configurations: PPP clients, DHCP, and DNS. (Unfortunately, Linuxconf is still a work in progress, so it is not very well documented.) Even better, if you use Red Hat's boot disk creation script during installation, it can store your network and XF86Config information so that you don't have to enter much of this information.

Red Hat is known for its package manager

(RPM), an open-source program that is used in many other distributions as well. RPM lets you safely install and uninstall applications, avoid conflicts between programs, and even upgrade the kernel itself without having to reinstall your system software or files.

Official Red Hat Linux 5.2. Price: 3-CD set, Linux kernel 2.0.36, boot disk, installation guide, 90 days technical support, $74. Requires: 386-based PC or better, 16MB RAM, 120MB RAM (450MB for Workstation, 1.6GB for Server). Everything Linux; Ph: 02 9798 7604, Fax: 02 9798 2854, www.everythinglinux.com.au

HOW WE TESTED

To evaluate these four distributions of Linux, we set up a basic server on a network. First, we installed the operating system and configured our hardware, network connection, and system options. To install a network, we set up TCP/IP to support local Windows 98 workstations as well as an Internet connection. IP addresses for the local workstations were provided by a DHCP (Dynamic Host Configuration Protocol) server and resolved by a local DNS (Domain Name Service) server, both of which were running on the Linux server. Our test systems were Micron Millennia PCs each with a 200MHz Pentium MMX chip, 64MB RAM, a 4GB hard disk, an 8X CD-ROM drives, a Diamond Stealth 3D 2000 graphics adaptor with 2MB RAM, and a 3Com 3C509b EtherLink III network interface card. —*LS*

LICENSE TO DRIVE SOFTWARE DEVELOPMENT

To make sure all this development can happen without corrupting the original projects, all open-source projects are governed by licenses that lay out the rules for using, modifying, and distributing the source code. Several different licenses have evolved over the years.

The most famous open-source license is the GNU Project's General Public License (*www.gnu.org*). The GPL, also known as the *copyleft*, requires that the program be distributed with source code and that all derivative works must also be distributed with source code. The goal of this license is to make the program and the work built on it perpetually "free". The Linux kernel, GNU programming tools such as the C Compiler, and Samba, which makes Linux servers look like Windows NT file and print servers, are all examples of GPL software.

At the opposite extreme is the BSD license—first used for the Berkeley Software Distribution of Unix—which is the least restrictive. Under the BSD license, you can tweak the code a little, compile it, put it on a CD, and sell it for a million dollars—assuming you can find someone willing to pay for it. Purists object to the BSD license because it can let a program become fragmented as developers spin off their own proprietary versions. In practice, many developers opt to give their work back to the community anyway. Apache, BIND, and sendmail are all loosely governed by the BSD license.

Recently, some notable commercial software companies have developed their own open-source licenses. Communicator 5.0, for instance, operates under the Netscape and Mozilla Public Licenses (*www.mozilla.org/NPL/*). This license is based on the GPL, but it also grants special rights to Netscape and its development partners. And Sun Microsystems announced that the Java Virtual Machine would be available under Sun's Community Software License (*java.sun.com/features/1998/12/source_license_QA.html*). All derivative products are still required to pass Sun's compatibility tests, which carry a licensing fee.

To capitalise on the momentum generated by these announcements, last year

several prominent open-source advocates established a watchdog group, the Open Source Initiative (*www.opensource.org*), to legitimise open-source software and bring it into the business world. As we discuss in the following sections, there are strong indications that projects such as Linux and Apache are already starting to make that transition.

Key Open-Source Projects

The most famous and controversial open-source project is undoubtedly Linux. Famous because from its humble beginnings as the pet project of a university student, it has grown to become the leading open-source operating system. And controversial because it has become a focal point for those seeking to break Microsoft.

The root of Linux was a scaled-down version of Unix known as Minix. In 1991, a Finnish student, Linus Torvalds, modified Minix, adding task switching, basic hardware support, and a file system. Torvalds posted his creation on an FTP server and invited programmers to try it for themselves. Today, more than 1000 developers contribute to the Linux kernel (*www.kernel.org*), which encompasses all the core OS features, the file system, and the network stack. And the project has grown so large that major areas of work have their own "lieutenants".

Linux has rapidly grown into a formidable competitor that runs on all major processors (*x*86, Alpha, MIPS, PowerPC, and Sun SPARC) and supports multiple users, multitasking, virtual memory, and TCP/IP networking. As we were completing our story, Torvalds released the long-awaited Version 2.2.0 kernel, which adds support for some 64-bit platforms, limited ability to read and write Windows 98 and NT file systems, enhanced support for SCSI devices and network interface cards, and new multimedia features.

Many of the programs included in a Linux distribution are also open-source projects, including the GNU Project's developer tools and applications, as well as the Xfree86 server, the platform for a GUI. Another program included with most distributions, the Apache Web server, is probably the most successful open-source venture to date. More than half of the domain names on the Web are handled by Apache, according to Netcraft's Web Server Survey (*www.netcraft.com/survey*), making it far more prevalent than competitive products from Microsoft and Netscape.

Apache was born in 1995 when a small group of developers consolidated a series of patches they had made to America's National Center for Supercomputing Application's (NCSA's) HTTP daemon (the name is a play on "A Patchy Server"). A year later, Apache was the most popular server on the Web. Currently, a team of about 20 developers, known as the *core*, coordinates the Apache project (*www.apache.org*). Recently, IBM announced it would use the Web server in its WebSphere application server for e-commerce applications, lending some of Big Blue's corporate credibility to the open-source project.

THE BASICS OF A LINUX DISTRIBUTION

Although the essence of Linux is the kernel, it takes much more to make a complete operating environment. Here are some of the key elements of a typical Linux distribution.

Boot manager The boot manager is a utility that resides in the master boot record (MBR), which is loaded by your computer's BIOS at startup. If you add Linux to a system with Windows or other OSes, the boot manager lets you select which OS you'd like to run. Although there are third-party boot managers such as V Communications' System Commander, Linux includes its own boot manager, known as LILO (LInux LOader), which is usually installed by default.

User interface At its core, Linux is a derivative of Unix, and its default interface is a DOS-like command line. To make Linux more accessible, there are several graphical desktop environments that make Linux look and feel more like Windows or Macintosh OSes. Examples include CDE (Common Desktop Environment), KDE (Kool Desktop Environment), and GNOME (GNU Network Object Model Environment).

X Window system Like Windows' GDI (Graphics Device Interface), X Window is the graphics subsystem that supports a graphical user interface. One of the most common X servers is Xfree86 (www.xfree86.org). During setup, you can choose whether to install an X Window system.

Internet services Linux has native support for TCP/IP and all common Internet protocols, including DNS (Domain Name Service), HTTP (Web server), SMTP (e-mail), FTP (File Transport Protocol), NNTP (news), and PPP/SLIP (for dial-in accounts). Most distributions include Apache, the popular open-source Web server, as well as Web browsers, e-mail clients, news readers, and other Internet applications.

File and print services These services allow a system to access network resources and share files and printers with other users. Typical services include NFS (Network File System) for sharing files with other Unix-based systems; Samba, which makes Linux systems look and act like Windows NT servers; and AppleTalk.

Applications Linux does not yet enjoy the same widespread application support that Windows does. But most distributions bundle literally hundreds of applications, and if you're willing to look, you'll find a good variety of tools elsewhere. In addition to basic text editors such as Crisp and XEmacs, there are several productivity applications and suites. GIMP (GNU Image Manipulation Program) is an Adobe Photoshop clone.

Package managers Package managers are tools designed to install, uninstall, and upgrade applications on a Linux system. The Debian Package Management System and Red Hat Package Manager (RPM) are well-known package managers.

Developer tools Since Linux is a favourite of programmers, it is not surprising that distributions include many developer tools. These include utilities for managing and building programs from source code, debuggers such as gdb, compilers such as egcs and gcc, programming languages, and scripting languages such as Python and TCL.

Libraries Linux includes a core set of library routines (libc). Like the dynamic link libraries (DLLs) found in Windows, libcs are executable modules that perform behind-the-scenes functions that support other applications. Most distributions include many libraries; common types include GNU Libc (glibc) and Libc5.

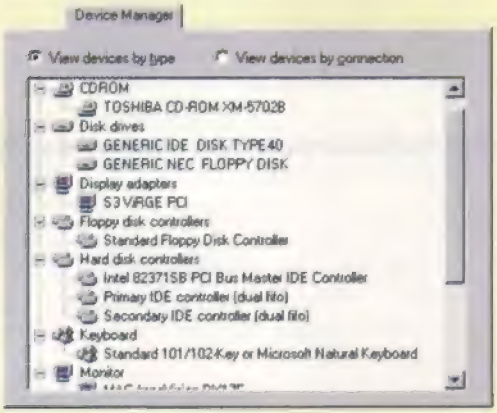
HOW TO INSTALL LINUX

■ A step-by-step guide for Windows users

Linux has come a long way, but don't expect the installation to go as smoothly as your upgrade to Windows 98. To get it right, you'll need to do a little research and take some preliminary steps to prepare your system to run multiple operating systems. For complete details, read the documentation that is included with your distribution and The Linux Documentation Project at *http://metalab.unc.edu/LDP*.

1 Before You Begin

A. Collect System Information Although Linux can automatically recognise many hardware devices, it is hardly foolproof. To complete your installation, you may need to enter information manually, so the first step is to collect all the information on your hardware devices (make and model numbers) and their configurations. If you're using Windows 95, 98, or NT, the easiest way to do this is to print the information from the Device Manager tab in the System Properties dialog box (Control Panel | System).



B. Create a Boot Disk The simplest way to install Linux is to boot directly to the distribution CD-ROM, but only a handful of new PCs allow bootable CD drives (you can check this in your system's BIOS settings). Most users will need to boot from a floppy disk. Caldera OpenLinux 1.3 and Red Hat Software's RedHat 5.2 include boot disks, but most distributions require you to create your own boot disk using an included utility such as Rawwrite.

C. Create Room on Your Hard Disk Because of the many bundled applications, the size of a typical Linux workstation installation varies widely, from about 100MB to 500MB or more. Linux must be installed on its own partition. If you have only one partition, devoted to Windows, you'll need to create some space for additional partitions. First, make a backup of your existing system and run the Windows disk defragmentor to place all existing data in one area of your drive. To resize your current partition, you can use a DOS utility called FIPS or a third-party tool such as PowerQuest's PartitionMagic 4.0 or V Communications' Partition Commander.

2 Installation

A. Options for Installation There are a variety of ways you can install Linux, including from your hard disk, a shared disk, or a CD-ROM. Installing from a CD-ROM is probably the most convenient. As your system boots, Linux will attempt to detect your hardware. If it fails to recognise your hardware correctly, you'll have to tell Linux about your devices by entering the information by hand. The actual installation program should be a step-by-step, interactive process similar to that of Windows, although less graphical.

B. Create and Edit Partition Tables During installation, you will have to edit the new partitions you've created. To do so, you'll need a utility such as the included fdisk (which is not the same as DOS's fdisk), cfdisk, or Red Hat's Disk Druid. Now you'll need to create at least two partitions: a root partition that contains the Linux kernel (the core components of the operating system) and a swap partition that Linux will use for virtual memory—an extension of your system's RAM. Many users also create separate partitions to hold applications and home directories.

C. Configuring the GUI Although Unix experts can get along just fine in a command line world, you'll probably want to install a graphical user interface (GUI) to make Linux a little more user-friendly. There are several graphical environments to choose from, but all of them require a basic platform called the X Server. The most common X Server is called Xfree86. During installation, choose the option to install an X Server. To configure it, you may need to enter some detailed information about your mouse, graphics adaptor, and monitor, including the monitor's scan interval and refresh rate. Be sure to enter this information correctly: the wrong settings can damage your hardware.

D. The Final Steps At this point, the actual installation should take place. Once completed, the setup takes you through a series of menus that will help you to configure your system. Since you'll be running both Windows and Linux, you should opt to install LILO (LInux LOader), a multiboot utility for Linux systems.

3 Running Linux for the First Time

A. Log-On When you first boot your system, you'll be prompted for a log-on ID. You'll want to log on as "root". If you are using LILO, you may have to hold down a key, such as the Ctrl key, during boot to access a boot prompt where you can choose which OS to load.

B. System Configuration After installation is complete and you have booted for the first time, you might have to perform basic administration and configuration tasks. These can include setting up a hostname, reconfiguring the X Server to meet your needs, or configuring LILO to handle all of your operating systems properly. —*Matthew Graven*

NETSCAPE JUMPS ON THE BANDWAGON

In a sense, Netscape Communications built its Internet empire on free software, transforming NCSA's Mosaic browser into the hugely popular Navigator and later the Communicator suite. Nevertheless, observers were shocked when, a year ago, Netscape suddenly announced that it would release the source code for Communicator 5.0.

At the time, Netscape's share of the browser market was withering under a relentless assault by Microsoft. So the move was perhaps in some measure a marketing ploy designed to ally the company with an increasingly popular (anti-Microsoft) movement. But it also marked the first time a major software company had opted to give away the code to one of the world's most popular applications. From an end user's standpoint, the new development effort, managed by the semi-independent Mozilla.org, promises to bring some significant changes in the Communicator suite.

Like a restored vintage auto, Communicator 4.5 looks great on the outside, but its engine is sorely out of date. The next version of Communicator will be built on an entirely new HTML engine. This overhaul will offer several advantages

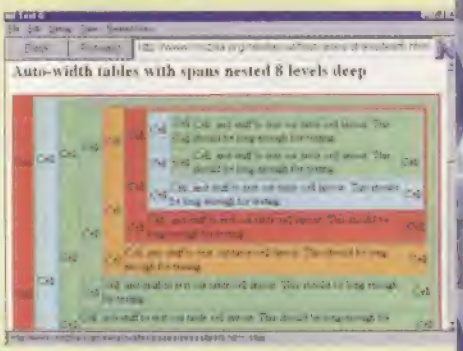
First, the browser should be significantly faster. For example, Netscape claims that the new engine renders HTML tables up to 20 times as fast as earlier versions. We took a look at an early preview version of the engine, code-named Gecko, and it does indeed appear to be noticeably faster than Communicator 4.5, even when loading pages stored locally.

Second, Communicator 5.0 should be more standards-compliant. This will be a big improvement for Web page designers, who often have to create two versions of each page because of different implementations of standards such as Dynamic HTML (DHTML). Netscape promises full support for XML and Cascading Style Sheets (Level 1).

Finally, Communicator 5.0 will have a more modular architecture. That means customers can download only what they need—a lightweight browser, for example. More important, the "componentisation" of Communicator is also part of a strategy to make it more attractive to other technology companies as a platform. In this area, Netscape is playing catch-up with Microsoft, which introduced a component-based architecture as early as Internet Explorer 3.0, and has been reaping the benefits. Even America Online, which now owns Netscape, uses IE as the browsing platform in its client software.

To ensure that Communicator 5.0 would be an attractive platform for other software companies, Netscape wrote its own licenses for the Mozilla source code. Unlike the GPL license, the Netscape/Mozilla Public Licenses let other companies modify and redistribute Communicator without releasing the code for their derivative works.

Of course, Microsoft is not resting on its laurels. Internet Explorer 5.0 has been released and it includes a long list of usability enhancements, including better management of Favorites, improved off-line browsing, and more powerful search features.



Gecko displays HTML tables faster.

If you're really adventurous, you can download an early version of Netscape Gecko (developer.netscape.com/software/communicator/ngl/index.html). But it shouldn't be long until the real program arrives.—*MG*

Although it has less visibility, Perl has also become a major open-source success. Known as "the duct tape of the Web", Perl is a scripting language that was created in 1987 by developer Larry Wall. A versatile tool, Perl can manipulate text strings, automate tasks, and connect seemingly incompatible programs. Because of its text-handling strengths, Perl is primarily used on the Web to create HTML on the fly.

Perl is currently in its second iteration. Development is managed by The Perl Institute (*www.perl.org*), which maintains message boards and a compilation of new patches. According to the institute, there are over 1 million Perl users worldwide.

Open-Source Means Business

Despite the success of projects such as Linux, Apache, and Perl, open-source software has had a hard time gaining entrée into the corporate world. Often system administrators and programmers have had to sneak Linux in through the backdoor. In the past year, however, Linux has cast off that role and emerged as a legitimate business solution. While there's still a lot of work to be done before it can compete for the desktop, Linux is making major inroads as a server operating system.

Last year, Linux was the fastest growing server operating system, according to a recent study by IDC. Although Windows NT Server and NetWare still have larger shares of the market, Linux shipments grew by more than 212 percent, giving it 17 percent of the market, or about the same as all other flavors of Unix combined.

There are several reasons for Linux's growing popularity as a server OS: (1) it is a true multiuser, multitasking OS, (2) it is perceived as reliable and scalable, (3) it works on a wide range of hardware and runs comfortably on a 486 with 8MB of RAM, (4) it supports virtually all standard networking and Internet protocols, (5) it is readily customisable, thanks to its open nature and a wealth of developer tools, and (6) you can't beat the price. The latest official release of the kernel, Version 2.2.0, adds a critical component: support for symmetric multiprocessing (SMP).

These strengths are helping Linux find new roles in business. In larger organisations, Linux is emerging as a popular "single-function" server. For example, Cisco Systems uses Linux to run its major print servers, and Sony Worldwide serves up Web pages on an intranet using Linux and Apache. At the same time, leading Linux distributors such as Caldera Systems and Red Hat Software are positioning Linux as a turnkey solution for small to medium-size businesses that want to set up networks and run their own Web sites. Of course, Linux's success among ISPs is well known.

On the client side, Linux is not as well positioned to grab market share from Microsoft, largely because it is still too difficult to use. Nearly all open-source

products were created by programmers to "scratch an itch"—that is, to address particular problems. Consequently, there was not much concern for how others, especially end users, might use a given program. Unix users will feel right at home in Linux, but even advanced Windows users will find it daunting at first. The rest should steer clear until Linux gets an easier install, solid hardware support, a consistent GUI, and more third-party productivity applications.

Several groups are currently developing GUIs that make Linux look more like Windows or the Mac OS. The leading candidate is KDE (Kool Desktop Environment), a graphical desktop environment, bundled with Caldera OpenLinux. KDE (*www.kde.org*) makes Linux look and act like Windows. GNOME (GNU Network Object Model Environment) is a more ambitious project led by Red Hat Software to create a graphical environment using CORBA (*www.gnome.org*).

Perhaps the most significant recent advance has been the expansion of applications support. Corel recently released a version of WordPerfect for Linux, and several companies including Applix and Star Division have developed integrated office suites that offer functionality similar to Microsoft Office and even support Office file formats. Meanwhile, IBM, Informix, Sybase, and Oracle are all porting database products to Linux.

To present a real challenge to Microsoft's mainstream operating system, Linux must make more concessions to the typical user. But as a server operating system, Linux has what it takes to compete with Unix and Microsoft Windows NT.

Open-Source vs. Goliath

There is little chance that Linux will knock Windows 95 or 98 off your desktop anytime soon. Microsoft maintains a comfortable lead on the client side, because no other *x*86 operating system can match its breadth of applications or ease of use. But on the back end, the picture is less clear. Windows 2000, Microsoft's answer for enterprise computing, has been delayed repeatedly, and there's still no certainty that the OS can deliver the goods. Meanwhile, Linux is shaping up to be a real player in the server operating system market, posing a new threat to the monolith's market dominance. While we don't expect Microsoft to join the open-source movement, you can bet that the phenomenon is on Redmond's radar.

Although describing Microsoft as "a better imitator than innovator" is overstating the case, the company nonetheless has a record of quickly adapting to new competition—as it demonstrated in 1995, when Netscape Navigator became a threat. Microsoft's competitors now see Linux as a way to break the Wintel bloc, and many are planning to support Linux with future releases. Nevertheless, Microsoft doesn't yet see the same threat in Linux that it did in Netscape's Internet products.

One reason is that Microsoft thinks the hype greatly exceeds Linux's actual presence in the marketplace. There is no doubt the Linux market is growing; Red Hat estimates there are 5 to 10 million users. But that still represents only a fraction of the total number of operating systems shipped on new PCs—95 percent of which will be Windows this year, according to Dataquest. Microsoft also argues that Linux is growing at the expense of Unix, not Windows NT, and there is some data to support this assertion. Furthermore, as Microsoft points out,

APACHE RULES THE WEB

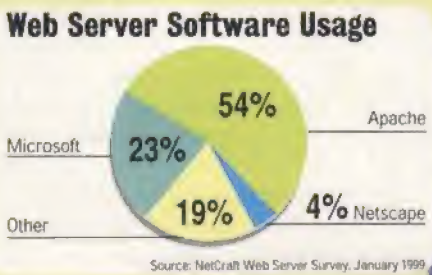
No program has done more to dispel the notion that open-source can't survive in the real world than the Web server Apache. More than half of the domain names on the Web are served up by Apache, according to Netcraft's survey of some four million sites. Apache's closest competitor, Microsoft Internet Information Server (IIS), handles only about half as many sites. When you look at what Apache offers, you can easily see why it enjoys such success.

Because Apache is an open-source program, loosely governed by the anything-goes BSD license, developers are free to do what they please with it. This freedom, along with some other developments, has made Apache ideal for ISPs, which typically have the in-house expertise to take advantage of the flexibility.

With Apache, Webmasters can add their own extensions and compile these changes right into the Web server. An Apache module called Mod_perl is a good example. Many sites use CGI (Common Gateway Interface) scripts written in Perl to deliver dynamic content on Web pages. Mod_perl embeds a Perl interpreter in Apache, which speeds up scripts and lets Webmasters extend the functionality of the server.

IIS provides similar capabilities using a feature called Active Scripting. By using COM interfaces, you can plug various scripting engines into the Web server. Although these engines are not compiled into the server, they do run in the same process space as the Web server, so they provide many of the same advantages. JavaScript and VBScript are the default scripting engines; others are available from third parties.

The most conspicuous difference between the products has to do with day-to-day administration. Administrators can configure virtually any aspect of Apache—short of recompiling it—and send a signal to the server to reload all of its components on the fly. In order to do this, the Apache administrator must modify a series of configuration files. Whereas IIS servers currently offer a graphical interface for configuration, Apache's graphical module is still in the works. It's based on Linuxconf, the popular configuration tool for Linux (www.solucorp.qc.ca/linuxconf), and should alleviate this problem. Other groups have similar efforts underway.



Both Apache and IIS have scored deals with some of the biggest sites on the Web. Sites such as Yahoo!, GeoCities, the W3 Consortium, and (oddly enough) Microsoft HotMail all entrust their servers to Apache, while IIS keeps Dell, eBay, and Onsale in business.

For some users, IIS strikes a fine balance between power and usability. But many Webmasters want all the power and configurability that Apache delivers. Clearly, the market is big enough for both. —*LS*

Linux's success is tough to gauge because users may be downloading the OS but not adopting it.

Linux loyalists often claim that the OS is technically superior, boasting of its bulletproof reliability. Microsoft counters that Linux has not been truly tested in the enterprise. For that matter, Windows NT still has a lot to prove in the enterprise, so there is little empirical evidence to support either side on this score. Windows has an obvious lead in usability, though: even Linux vendors concede that developers have paid little heed to ease-of-use issues in Linux.

Other barriers to Linux have to do with the perceived limitations of the open-source model. Microsoft points out that as the operating system becomes more mainstream, developers will be hesitant to give away their expertise. When you add to this the customer-support issues, the odds of Linux's breaking out seem long.

This does not mean that Microsoft isn't paying attention to Linux and to open-source software in general. Microsoft made headlines when a series of controversial memos on open-source and Linux, written by one of its engineers, were leaked to the open-source community in the last week of October—earning them the nickname "the Halloween documents" (*www.opensource.org/halloween.html*).

Officially, Microsoft acknowledges only that Linux is a legitimate contender for specific markets such as general-purpose servers and small to medium-size ISPs.

Although the company remains skeptical of the open-source model, Microsoft has distributed source code for some of its products in certain cases. For instance, Microsoft has released portions of the code for Windows and Windows NT under nondisclosure agreements to various commercial and research entities.

Linux is not going to overtake Windows anytime soon, nor force Microsoft to rethink the way it does business. But whether Linux can beat Microsoft is not the real question. It is not just conceivable but likely that Linux will continue to win converts and evolve into a more mainstream OS, even as Microsoft maintains its grip on the desktop. The many companies that are already thriving by selling software and services based on Linux and other open-source projects attest to this.

The Players to Bet On For Open-Source

One of the strangest lessons of the Internet era is that the fastest way to make money is to give your products away. The open-source movement takes this a step further by giving away the code behind the products. That's as if Coca-Cola not only gave away its soft drinks but also distributed the secret recipes and let people use them to make their own colas. All of which begs the question, just how are companies going to grow their business on open-source software?

Linux will continue to win converts and evolve into a more mainstream OS, even as Microsoft maintains its grip on the desktop.

Perhaps the most familiar model for making money with free software is to brand it and distribute it with other products and services. Caldera Systems (*www.calderasystems.com*) and Red Hat Software (*www.redhat.com*) are popular examples. Both companies have built businesses around the free Linux kernel by adding features that make it easier to use and more capable, and then providing reliable distribution and offering technical support.

The most common model for making money with free software is by branding it for distribution with other products and services.

Red Hat recently announced a certification program, and Caldera sells commercial software for Linux, such as NetWare for Linux.

Another formula is to give away a product and its source code as a way to expand market share and promote related products and services. This is essentially the business model behind Microsoft Internet Explorer and Netscape Communicator, both of which can be freely downloaded and distributed. Netscape has taken it a giant leap further with Mozilla. Aside from producing a faster, more reliable browser, Netscape hopes the move will promote its other businesses, such as the server software and Netcenter portal. Sendmail Inc., the corporate offspring of the highly successful mail-transfer agent called sendmail, continues to enhance the open-source product while also developing commercial versions such as Sendmail Pro.

Hardware makers can also benefit by leveraging the strengths of open-source operating systems to create new devices. One example is the Web server appliance, a turnkey server for small businesses or workgroups. The Cobalt Qube and Corel NetWinder (soon to be acquired by Hardware Canada Computing) are vying for a piece of this market. These products add value by masking the powerful features of Linux and FreeBSD behind browser-based interfaces for Web server administration.

VA Research takes the headaches out of installing and configuring Linux by selling preconfigured workstations, servers, and notebooks. Even major PC vendors such as Compaq Dell, Gateway, and Hewlett-Packard have announced plans to sell Linux servers. As the installed base of Linux broadens, other companies are stepping in to provide customer support. LinuxCare (*www.linuxcare.com*), for example, provides support for Caldera, Debian, Pacific HiTech, Red Hat, Slackware, and SuSE Linux distributions.

As more and more companies join the open-source movement, the hardware, software, and support options will rapidly multiply. Once that occurs, open-source software will be a viable alternative—and one that all businesses should consider.

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what's next

By James Tod

This wasn't just any year in the PC scanner business. Prices for high-quality colour flatbed scanners fell dramatically. More importantly, CIS (contact image sensor), a new technology that has resulted in significantly smaller and lighter scanners, has debuted to compete with traditional CCD (charge-coupled device) engines.

The explosion of inexpensive PCs for home users, easy-to-use image-editing software, and the pervasive use of colour photos in both professional and family documents and Web pages have made colour flatbed scanners almost ubiquitous desktop peripherals. Most of the scanners we tested can be easily installed in minutes, and their point-and-scan interfaces are relatively simple to operate.

A CHALLENGE TO CCD?

Until recently, the heart of all colour flatbed scanners (as well as camcorders and digital cameras) was a tiny photosensitive semiconductor chip, called a CCD. Scanning using a CCD requires an elaborate system consisting of mirrors and a lens to focus the image on the CCD. This complexity is somewhat costly, and the delicate optics can become misaligned, adversely affecting scan quality (see the diagram "CCD vs. CIS").

Enter the contact image sensor, which replaces the CCD scan head and lenses with a row of 300 or 600 sensors as wide as the scanbed and positioned only a millimetre or two below the original. CIS eliminates the CCD housing, mirror and lens, and the fluorescent or cold cathode tube. What's more, the sensors' proximity to the original means that flatbed scanners can be made as thin as or thinner than a laptop.

Another bonus: CIS's extremely low power consumption means that it can run off battery power or a powered USB port. However, as our tests of three CIS scanners demonstrated, image quality and colour fidelity are no match for even inexpensive CCD-based units. If you plan on scanning mostly text, then one of the new CIS scanners may prove enough. But for frequent photo scanning, stick with CCD for now.

SEGMENTED MARKET

Though there is considerable overlap, flatbed scanners generally fall into three categories: home, business, and professional graphics.

Home/SOHO scanners target casual, non-professional users whose final output is to an inkjet printer or a home page on the Web. Most are inexpensive letter-size scanners that offer easy parallel-port or USB connectivity, and won't accommodate ADFs (automatic document feeders) or transparency adaptors for scanning slides and negatives.

Business users also value simple setups and ease of use, but they are more concerned with issues like speed and throughput, durability, robust OCR (optical character recognition) software, and batch scanning. Business scanners often have A4-size beds, as well as the ability to add an ADF. Businesses typically use scanners for producing newsletters, creating presentations, archiving documents, and capturing images for the Web. They require the ability to calibrate (match) colours accurately, maintain a sharp image, and support a relatively high optical resolution to enable scaling up (enlarging) originals to a desired output size.

And since the scanner gets used all day long, speed—and hence a SCSI interface—is a must. Also, software drivers for professional graphics use offer more precise tools for fine-tuning image quality and colour.

SPECS AND A GRAIN OF SALT

Don't make the mistake of selecting a scanner based primarily upon the three numbers that manufacturers tout to entice buyers: optical resolution, interpolated resolution, and colour bit depth. In the numbers game, more is usually perceived as better. But in real-world scanning, high resolution, and higher bit depth may be unimportant to most users. Here's why.

The figures vendors cite for interpolated resolution (many manufacturers boast of software-enhanced resolutions of 4800 x

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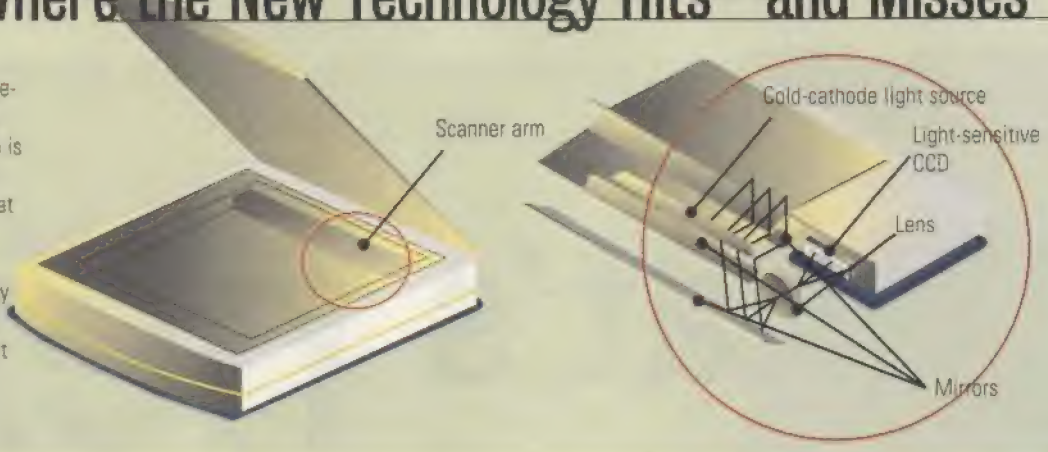
CCD vs. CIS: Where the New Technology Hits—and Misses

CCD Scanners

Traditional scanners use a CCD (charge-coupled device) semiconductor chip to capture and digitise image data,which is passed to the chip through a lens and mirror optical system. In this somewhat elaborate system, the optics can become misaligned, and the scanner needs mechanism. But CCD technology is still the most reliable for producing the best-quality scans—assuming that the best components are included.



4800, or even as high as 9600 x 9600) are marginally useful for line-art scans and precious little else, and they can be safely ignored. Optical resolution is the more useful figure. It refers to the number of points or dots that can be scanned per inch (reported in dpi); the more points, the greater the detail.

Although a scanner should have enough resolution to capture details in the original faithfully, unless you plan to enlarge a small original to a larger print or wish to scan 35mm or similarly small negatives or transparencies, you probably don't need a scanner with an optical resolution higher than 300 x 600dpi—a threshold all of the scanners we tested meet or exceed. Sharpness is determined by the quality of the optics and the precision of the scanning mechanism, more so than by resolution, and scan resolutions that are unnecessarily larger than your intended output will slow your entire system to a crawl and gobble up hard disk space.

The third spec is *colour bit depth*, typically 24-, 30-, or 36-bit. Theoretically, higher colour bit numbers mean that more details in highlights and shadows can be captured accurately. Most inexpensive scanners can scan internally in 30- or 36-bit colour, but when the image is converted to digital data, it is sampled down and saved as a 24-bit file. Manufacturers justify their greater bit depth capture by explaining that the scanner's firmware automatically analyses the image file on the fly and selects the best 24 bits of colour to save.

MOVING BEYOND RESOLUTION

Other considerations should probably carry more weight for home and business users than resolution or bit depth. If your originals are larger than A4-size, you'll need to confine your search to one that features a larger copyboard. Is speed important to you? A rough rule of thumb is that SCSI scanners are usually faster than USB devices, which are faster than parallel scanners.

Some of the units we tested let you add an ADF. There are units with a convenient software copy function that turns your scanner and printer into a personal photocopy machine.

Consider the scanner's software package. Most of the models here offer a novice-friendly point-and-scan driver interface that will have you scanning in no time. More advanced users will want a package that offers low-level control over a wide range of image attributes.

We were unable to test Epson's latest flatbed scanner because it arrived too late for this review.

Agfa

SnapScan 1212U and 1212P

Building on an already strong low-end product, Agfa have introduced new USB and Parallel port scanners called the SnapScan 1212U and SnapScan 1212P. The only difference between the two scanners is the interface, and we found the setup and subsequent use of each unit was particularly easy. Designed for the small office, art student or home office the 1212U and 1212P scanners fill their roles very well.

The footprint of the Agfa 1212 units is roughly the same as that of many of the other products reviewed, with the actual scanning surface just bigger than that of an A4 page. Each scanner was detected by Windows 98 and the loading of the driver and TWAIN software was simple enough, with the total time taken no more than five minutes. With the Agfa units you have a choice of either FotoLook or FotoSnap as TWAIN interface software, with FotoSnap for automatic work or FotoLook for more versatility and flexibility. In terms of internal specification both SnapScan units have an optical resolution of 600 x 1200dpi and 36-bit colour depth.

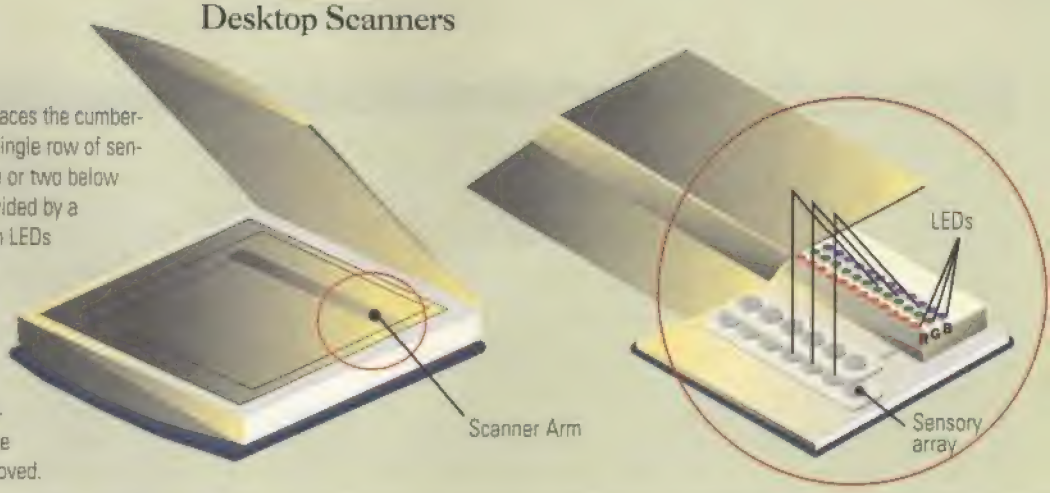
In testing we found both the Agfa SnapScan units did very well especially the USB version. In the colour tests, the parallel version suffered slightly, while the USB scanner posted times that put it in a strong position for both the 150dpi and 300dpi tests. In the grayscale tests the parallel port scanner really improved its position with a top seven finish. The USB scanner on the other hand really showed off with a blistering seven seconds for the 150dpi test, finishing on top. This continued in the 300dpi test with another first position and a time of just 12 seconds.

SnapScan 1212U

The strength of the SnapScan 1212U and 1212P scanners is their overall ease of use, excellent software bundle, speed and quality. With that in mind we feel that these scanners would serve you well. And their price of $289 makes them even more attractive. The pick of the bunch is obviously the

CIS Scanners

A CIS (contact image sensor) scanner replaces the cumbersome optical reduction technique with a single row of sensors, which is positioned only a millimetre or two below the original document. Illumination is provided by a closely packed row of red, blue, and green LEDs to create white light. LEDs draw far less power than the bulbs used in CCD scanners.CIS also eliminates the elaborate housing typical of CCD systems, so a scanner can be thinner than a laptop. CIS resolution, however, is presently limited to 300 or 600 pixels per inch, and image quality and colour fidelity need to be improved.



USB version, but if you have an older system the parallel port version is still a good choice.

SnapScan 1212U and 1212P. Price $289 (as tested). Agfa -Gevaert. Ph: 03 9264 7711, Fax: 03 9264 7860; www.agfa.com.au

Agfa

Duoscan T1200

The Agfa DuoScan T1200 is aimed at professional graphic artists, and it's priced accordingly. It is also impressively fast when compared to many of the other scanners reviewed, and produces good quality scans too. In total, the Agfa Duoscan T1200 is a very good package, even if the price means only business and professionals can afford it.

Setting up the SCSI-2 scanner was a fairly simple process, made easy by Windows 98 detecting all the hardware and using its own drivers where appropriate. After getting the hardware talking we loaded the TWAIN software which came on CD along with a great bundle of other software. Agfa's FotoLook driver offers a number of professional functions that perform a number of specialised colour-manipulation tasks, such as adding or subtracting particular colours (like red or gold). Even a casual user can easily work though the list to see what each choice does—advanced users should also be happy with the more sophisticated controls. There's more here than you would expect in a driver. In terms of other features the Agfa Duoscan T1200 includes a slide-out transparency tray that eliminates the need for a transparency adaptor for scanning slides and the like.

In testing we found the on-screen image quality was acceptable but not brilliant. Most details were fine, but some areas of our colour images were a little faded. Adobe Photoshop can be used to easily rectify these little niggles. The speed of the scanner was impressive, but we would expect it to be so with a SCSI interface and a big price tag. In the 150dpi colour test the Duoscan T1200 came in first, just in front of the HP ScanJet 6250C in a time of sixteen seconds. At 300dpi the Duoscan T1200 really showed off by posting the fastest time by seven seconds. The results in greyscale were less impressive with the Duoscan T1200

Duoscan T1200

Editors' Choice

- Editors' Choice: Hewlett-Packard 5200C
- Merit Award: Genius ColorPage-View Pro

With such a broad range of scanners reviewed in this article, it is difficult to single out an Editors' Choice, but a number of scanners stood out. In general the Hewlett-Packard scanners again performed well with high-quality scans, especially in the Resolution test. The 6250C and 4100C did seem to produce overly saturated scans, that were visually pleasing but not as close to the original as they should be.

The Genius ColorPage-View Pro again did very well and with a price of $169 it is an excellent choice for the budget conscious. As a result, it receives the *PC Magazine Australia* Merit Award.

The Microtek Scanmaker X6 scanner also did very well in our tests, showing it has an edge in some respects. Only the prices of the Microtek range make them hard to recommend over the competition.

We also really liked the new and improved range from both Agfa and UMAX; and their new prices make them even more attractive. Canon's submissions were also very good with the LIDE technology really making significant improvements in the both speed and quality.

In the end, however, we could not find a scanner to beat the Hewlett-Packard 5200C. Not only is it very affordably priced, it produced excellent quality scans and in reasonable time as well. It also comes with a good selection of software and is robust enough to survive harsher environments.

If you need very good scanning at a reasonable price then we highly recommend the Hewlett Packard 5200C.

PERFORMANCE TESTS

Desktop Scanners

Testing was divided into four main sections: Colour, Greyscale, Speed, and Resolution. All scanners were tested with their default or automatic settings, which is what the average user would attempt when they first set up a scanner. Although most default settings could be improved on with a few minor changes, they were all generally very good and where significant improvement could be gained by "fiddling" it has been noted in the text.

The image-editing software used for all tests was Adobe Photoshop Version 5. This is a commonly supplied application with most scanners and allowed the use of any of the TWAIN drivers supplied. Each scanner was tested with its supplied TWAIN software and SCSI card.

Colour

There are a number of ways of measuring colour in a scanned photo. You could scan a calibrated colour test target like the Agfa IT-8 or Kodak Q-60, then measure the RGB or CMYK values of each colour with either PhotoShop or Corel Photo Paint. The alternative is to scan a colour image and allow a jury of viewers to pick the most accurate and most pleasing image produced on a calibrated computer screen or colour printer. Because both photos and colour depend on viewer perceptions we elected to go with both the jury and RGB measurement methods of testing.

A panel of RMIT PC Test Lab staff viewed the scanner target supplied by Corel. We had previously calibrated the monitor with a prescanned calibration image (the same monitor was used throughout testing). The Jury members were asked to list what they thought of various portions of the image paying particular attention to skintone and natural colours; they were also asked to comment on the amount of detail in the pleated and embroidered blouse.

Greyscale

Greyscale tests were measured from the greyscale calibration strip off the Corel scanner target. The greyscale strip comprised of a pure white at one end and a rich deep black at the other with 22 gradations in between. Both a greyscale scan and a colour scan (later converted to greyscale) were tested. The results of these tests were graphed to compare the different scanners.

Speed

Speed was measured with a stop watch for both colour and greyscale scans. Three times were taken for both colour and greyscale scans for each scanner to weed out any anomalous results. The average speed of the three scans was then recorded and graphed.

Resolution

Resolution was tested using a simple method of checking the quality of line scans in pairs. To do this we used a test pattern which contained a set of vertical and horizontal lines that were checked visually and compared to the original to get an indication of the scanner's optics. The tests were scanned in colour and we concentrated on the green channel as greyscale scanning typically uses only the green channel. The scanners were set to auto-exposure where possible and if clipping occurred we manually adjusted the brightness and contrast just to eliminate the problem.

slipping to third spot in the 150dpi test and second in the 300dpi tests.

With good image quality, but a relatively steep price it makes it hard to give the DuoScan T1200 an unqualified recommendation, but if you need excellent performance and a strong set of features this scanner is worth considering. For rofessionals who use a separate image-editing package the DuoScan is even better, as they can compensate for the small image imperfections.

Duoscan T1200. Price $1489.95 (as tested). Agfa-Gevaert. Ph: 03 9264 7711. Fax: 03 9264 7860; www.agfa.com.au

BBF Components & Peripherals

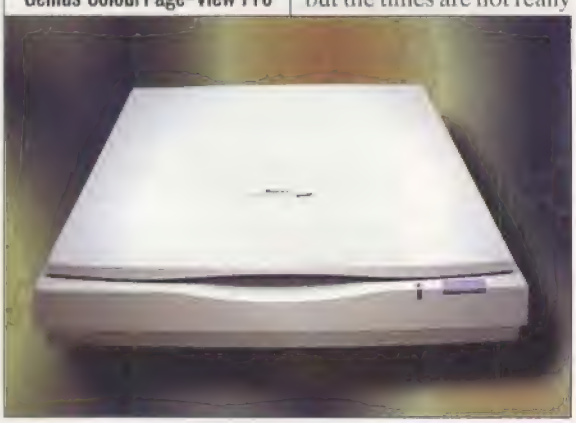
Genius ColorPage-View Pro

In one of our previous scanner reviews we particularly liked the Genius offering because it was affordable and did an excellent job. This new and improved version, with an increased optical resolution, has made it easy for us to continue our love affair with the product. Designed for the small office or home this scanner is small, light, feature-laden and its price of $169 cannot be beaten.

The scanner plate itself will accommodate an A4 or letter-sized page while the hinges on the rear of the unit ensure bulky objects can also be scanned. The interface between the scanner and the PC is parallel, with EPP support, and during setup was detected by our Windows 98 test system. The scanner features a 36-bit colour depth, with an interpolation of 19,200dpi. As well as being a great little scanner the software included with the unit is excellent as well. Those looking to produce Web sites would find PhotoImpact SE with WebExtensions compelling as it helps design buttons, backgrounds and GIF animations too. Xerox TextBridge OCR is provided for those looking to recreate hard copy documents in digital form.

The performance of the Genius ColorPage-View Pro was very good with middle-of-the-road finishes in the speed tests for colour at 150 and 300dpi. Quality was again excellent for this particular scanner with good colour depth, and sharpness throughout. In the greyscale tests the Genius slipped down the ladder a few notches, but the times are not really

Genius ColourPage-View Pro



going to slow you down too much.

We cannot fault the Genius ColorPage-View Pro package, with good results in every department except for the slower times in the greyscale tests. Those without big dollars to spend however will find this particular scanner even more exciting as its price was the lowest of those reviewed.

Genius ColorPage-View Pro. Price $169 (as tested). BBF Components & Peripherals. Ph: 03 9761 4299, Fax: 03 9761 4001; Freecall 1800 803 802; bbf.com.au

Canon

Canoscan FB620S & FB620P

When you first see the Canoscan 620S or 620P be prepared to be surprised—they weigh almost nothing! From the front to back both scanners are 37cm, from one side to the other 26cm and they are only 5.5cm high. Little feet on the left side of each scanner allow you to operate them on their sides. To ensure no damage to the head there is a lock for clamping the head assembly in place when you move the scanners from place to place.

We found both scanners very simple to set up indeed, but we only installed the required elements. If you want to install all the supplied software then expect the whole process to take 30 minutes or so. Other than the TWAIN driver, the Canoscan 620S and 620P come with the CanoCraft CS-P Copy program to duplicate a document. For photo editing and retouching you will find Ulead's iPhoto Express 1.1, and for OCR work there is OmniPage Limited Edition. Also on the CD you will find a copy of the Adobe Acrobat reader and the Canoscan manuals for reference.

At the heart of the changes Canon have made with the new scanner range is a CIS technology that Canon calls LIDE (LED InDirect Exposure). The very competitive pricing and small footprint can also be attributed to the LIDE technology as there are less moving parts, and they use much less power than a conventional setup. LIDE has four main components including: the LEDs, the LightGuide, the rod lens array, and the sensor chips. The LightGuide is mounted beside the lenses and is an optical technology that creates a uniformly bright light across the scan line by reflecting and/or diffusing the light beam. The LightGuide allows for an extremely compact light source while producing the highest level of uniform illumination. Many rod lenses with a diameter of less than one millimetre are placed along the scanning line creating a high-resolution image with absolutely no distortion. The quality of the image is ensured by the use of the new linear image sensor at the end of the rod lenses.

The scan times of both Canon units were more than acceptable, even though they did not break any speed records. In the 150dpi colour scan the SCSI unit took 29.5 seconds to perform the scan, while the FB620P took a slightly more leisurely 36 seconds. At 300dpi the FB620S jumped a few places to fifth spot, while the higher load pushed the parallel unit down

Canoscan FB620S and FB620P

Scanner Performance

Shorter bars indicate better performance	Colour Scan Time DPI 150	Colour Scan Time DPI 300	Greyscale Scant Time DPI150	Greyscale Scan Time DPI300
ArtiScan 636DX	22.5	67.5	14.0	29.5
DuoScan T1200	16.0	24.0	13.0	19.0
CanoScan FB 620S	29.5	58.5	20.5	21.0
CanoScan FB 620P	36.0	70.0	26.0	33.0
Genius Color Page-View Pro	33.0	66.5	31.5	42.0
ScanJet 4100C	19.0	61.0	12.0	34.0
ScanJet 5200C	26.0	31.0	23.0	31.0
ScanJet ADF 6250C	17.0	47.0	15.0	22.0
ScanMaker X6	36.0	37.0	37.0	38.5
SnapScan 1212 USB	28.0	79.0	7.0	12.0
SnapScan 1212 P	75.0	108.0	19.0	22.0
Umax Astra 1220 USB	44.0	87.0	24.0	27.0
Umax Astra 1220 P	41.0	84.0	25.0	26.0
Webstar 19236-EPP	42.5	88.5	18.5	32.0
Webstar 9636	43.0	64.0	26.0	29.0

SUMMARY OF FEATURES

Desktop Scanners

PC MAGAZINE AUSTRALIA MERIT AWARD

Product name	Duoscan T1200	SnapScan 1212P	SnapScan 1212U	Genius ColorPageViewPro
Supplier name	Agfa	Agfa	Agfa	BBF Components and Peripherals
Address	372-394 Whitehorse Road Nunawading 3131	372-394 Whitehorse Road Nunawading 3131	372-394 Whitehorse Road Nunawading 3131	4 Nicole Close Bayswater 3153
Phone number	03 9264 7711	03 9264 7711	03 9264 7711	03 9761 4299
Fax number	03 9264 7860	03 9264 7860	03 9264 7860	03 9761 4001
Web address	www.agfa.com.au	www.agfa.com.au	www.agfa.com.au	www.bbf.com.au
List price	$1490	$269	$289	$169
Warranty	1 year	1 year	1 year	2 years
Maximum optical resolution	1200x600	600x1200	600x1200	600x1200
Maximum interpolated resolution	3600	9600	9600	19,200
Number of passes for colour scans	1	1	1	1
Maximum scanning area (mm)	216x355	216x297	216x297	216x297
Internal colour depth	36-bit	36-bit	36-bit	36-bit
Interfaces standard (opt)	SCSI-2	Parallel	USB	Parallel
Sheet feeder option	Yes	No	No	No
Software provided	ColorTune, FotoTune,Corel Photo-Paint 8	FotoSnap, FotoLook, iPhotoExpress, Color-it (Mac only), Omni Page LE (PC only), Paper Port (including OmniPage Lite)	FotoSnap, FotoLook, iPhotoExpress, Color-it (Mac only), Omni Page LE (PC only), Paper Port (including OmniPage Lite)	iPhoto Express V1.1, PhotoImpact 3.02, Xerox Textbridge OCR, TWAIN driver
Dimensions (HxWxD in mm)	160x395x570	105x330x450	105x330x450	45x280x415

the ladder a few stops with a time of 70 seconds. We were very pleased with the bright, sharp and clear images produced by the Canon units. In the optical test, the Canon units were also very good, leaving lesser units in their wake with very strong dark straight lines.

The new technology that has gone into making this product has certainly given Canon the jump on everyone else for the moment. With some further refinements to their TWAIN driver there is little doubt Canon will make inroads into the territory held by some of the more established scanner vendors. If you have a need for a cheap, easy to use and above all great performing scanner give the Canoscan 620S & 620P a very close look as they are sure to impress.

Canon FB620S and FB620P. Price $299 (FB620P), $449 (FB620S). Canon Australia. Ph: 02 9805 2000, Fax: 02 9805 0168; www.canon.com.au

Dual Technologies

Artiscan 636DX

While the Artiscan 636DX was no speedster, it did well enough in both the performance and quality arenas to be considered very good value for money. Priced at $189 it is measurably more affordable than many of the others in this roundup. We found it handled all that was thrown at and it incorporates many of the higher-end features you would expect in scanners costing much more.

The rated optical resolution of the Artiscan is 600 x 1200dpi, with interpolation bumping this up to 9600dpi. Installing the hardware and software was a no-brainer with the test system detecting the scanner and asking for the driver, which comes on the supplied CD. The other software can be installed at a later stage (or not at all if you only intend to use the TWAIN interface). Scanning can be somewhat daunting if you don't want much more than a point-and-shoot interface and the TWAIN interface, while not industrial strength, it a simple affair that is very workable and easy to operate. The Artiscan comes bundled with Adobe's PhotoDeluxe, Xerox Textbridge OCR, DocuMan and DocuPal.

Despite having no I/O buffer the Artiscan was no slouch in the timing tests with a fourth placing in the 150dpi colour test. In the 300dpi test it fell slighlty, but for a parallel port scanner it was still more than acceptable. In terms of quality, the Artiscan did reasonably well, but the scans were a little dark in patches. We also noticed impure whites and a loss of detail in the shadows.

Artiscan 636DX

The individual pieces of the Artiscan 636DX together form a truly comprehensive package for consumers, with well-written and illustrated documentation. It is definitely a comparatively fast scanner, and while its scanning interface does need some refinement, it is more than adequate for a first time or more seasoned campaigner.

Artiscan 636DX. Price: $189 (as tested); Dual Technologies. Ph: 03 9887 7888, Fax: 03 9887 7868; www.tamarack.net

Canoscan FB 620P	Canoscan FB 620S	Umax Astra 1220U	Umax Astra 1220P
Canon	Canon	Computer Enterprise Australia	Computer Enterprise Australia
1 Thomas Holt Drive	1 Thomas Holt Drive	Unit 3, 5-11 Mellor Street	Unit 3, 5-11 Mellor Street
North Ryde 2113	North Ryde 2113	West Ryde 2114	West Ryde 2114
02 9805 2000	02 9805 2000	02 9807 5222	02 9807 5222
02 9805 0168	02 9805 0168	02 9807 5333	02 9807 5333
www.canon.com.au	www.canon.com.au	www.cea.net.au	www.cea.net.au
$299	$449	$329	$270
1 year	1 year	1 year	1 year
600x600	600x600	600x1200	600x1200
2400	4800	9600	9600
1	1	1	1
216x297	216x297	216x297	216x297
12-bit input, 8-bit per channel output	24-bit	36-bit	36-bit
Parallel	SCSI	USB	Parallel
No	No	No	No
Ulead iPhoto Express, OmniPage LE, OCR software, Canocraft CS-P TWAIN driver	Adobe Photo Deluxe, OmniPage LE, ScanGear CS-S TWAIN, CanoCraft CS-P, CanoScan Toolbox	Adobe Photo Deluxe, VistaScan, PageManager 4.0, PhotoAlbum LE, Omni Page LE	Adobe Photo Deluxe, VistaScan, PageManager 4.0, PhotoAlbum LE,Omni Page LE
63x256x372.5	63x256x372.5	99x312x471	99x312x471

Hewlett-Packard

HP ScanJet 4100C

HP's ScanJet 4100C comes in at the low-end in terms of pricing, but with high-end speed and quality it is far from a low-end scanner. The design of the unit is fairly typical, featuring a moderate footprint with good-sized rubber feet to prevent movement while scanning. Overall we found the setup of the HP 4100C very simple with the supplied large glossy page taking you through not only the hardware installation, but the software as well.

HP ScanJet 4100C

Starting a year or two ago, HP introduced external buttons on its scanners to increase functionality. The HP 4100C features two such buttons, one to activate the HP ScanJet copy software that then prints the scan, while the other starts the HP Precision LT software for conventional scanning. Although designed for novice users we found HP 4100C's TWAIN software particularly limiting, but it does mean there is little room for error in scanning documents of different types.

The performance of the HP 4100C was very good indeed with its times putting it in the top three for the 150dpi colour test, and in sixth position for the 300dpi colour test. In terms of colour quality and optical abilities the HP ScanJet 4100C continues a long tradition of producing excellent sharp and appealing scans, with results that our panel really liked.

Overall you can expect high quality and hassle-free scanning from this unit. It comes with a good combination of software, but most of all it is a great little scanner that is affordable, robust and will stand you in good stead.

HP ScanJet 4100C. Price $307 (as tested). Hewlett-Packard Australia. Ph: 13 13 47. Fax: 03 9898 1968; www.hp.com.au

Hewlett-Packard

HP ScanJet 5200C

PC MAGAZINE AUSTRALIA EDITORS' CHOICE

The new HP ScanJet 5200C offers a USB or parallel interface and continues the tradition of offering incremental upgrades of the HP ScanJet 5 range, bringing new features and capabilities to the mid-level PC scanner arena. The 5200C's ease of installation and use as well as improved image analysis may help insure HP's dominance in the scanner market for the next little while, but competition is growing.

The 5200C has a maximum document scanning area of 216mm by 297mm and an optical resolution of 600 x 1200dpi, with interpolation up to 9600dpi. The scanner's new IST intelligent Scanning Technology, based on 36-bit colour processing, includes several elements that speed up and simplify scanning while producing very clear images.

The HP 5200C follows the same rules as other USB scanners for setup: the software is installed first, then the hardware. The TWAIN software provides an easy-to-operate interface, but beneath the exterior is plenty of power. Other packages included in the HP bundle are Photo Deluxe from Adobe, Caere Pagekeeper and Hemera Netgraphics Optimiser.

Producing very warm and pleasant colour

SUMMARY OF FEATURES

Desktop Scanners

PC MAGAZINE AUSTRALIA EDITOR'S CHOICE

Product name	ArtiScan 636DX	HP ScanJet 6250C	HP ScanJet 5200C
Supplier name	Dual Technologies	Hewlett-Packard Australia	Hewlett-Packard Australia
Address	378 Burwood Highway Burwood East 3151	31-41 Joseph Street Blackburn 3130	31-41 Joseph Street Blackburn 3130
Phone number	03 9887 7888	1800 339 862	1800 339 862
Fax number	03 9887 7868	03 9898 6466	03 9898 6466
Web address	www.tamarack.net	www.hp.com.au	www.hp.com.au
List price	$189	$1036	$408
Warranty	1 year	1 year	1 year
Maximum optical resolution	600x1200	1200x600	600x1200
Maximum interpolated resolution	9600	1200	9600
Number of passes for colour scans	1	1	1
Maximum scanning area (mm)	216x297	216x297	216x297
Internal colour depth	36-bit	36-bit	36-bit
Interfaces standard (opt)	Parallel	USB, SCSI	Parallel, USB
Sheet feeder option	No	Yes, 25 pages	Yes, 25 pages
Software provided	Adobe PhotoDeluxe, Xerox TextBridge, Documan, DocuPal	HP Precision Scan Pro/ Lan,Caere OCR, HP ScanJet utility,Caere PageKeeper, AdobePhoto Deluxe Business Edition	HP Precision Scan 2.0 w/intergrated OCR from Caere, HP copy utility, Adobe Photo Deluxe Business Edition, Caere Pagekeeper standard edition, Hemera NetGraphics Optimiser
Dimensions (HxWxD in mm)	95x281x413.5	193x312x498	124x305x485

images, the HP performed very well in all our tests. As with some previous HP scanners there was a tendency to overdo the saturation, but this also seems to produce some of the most appealing scans.

In terms of speed the 5200C was quite good, but it was bettered by its little brother in the 150dpi colour test. In the 300dpi test the 5200C made up for the 150dpi result by posting the second fastest time at 24 seconds.

With all the bundled software and overall speed and quality, the HP ScanJet 5200C is hard to beat, and would be a great choice as a starter or utility scanner. If you need sharp images, good output, and solid reliability then the HP 5200C is an excellent choice and it costs just $408.

HP ScanJet 5200C. Price: $408 (as tested). Hewlett-Packard Australia. Ph: 13 13 47, Fax: 03 9898 1968; www.hp.com.au

HP ScanJet 5200C

Hewlett-Packard

HP ScanJet 6250C with ADF (Automatic Document Feeder)

As one of the top HP scanners for PCs we expected the ScanJet 6250C to do well, and it did. The asking price is certainly steeper than the majority of other units tested, but if you need speed, quality and the convenience of automatic document feeding then you should enjoy what this scanner has to offer. Designed for the art studio, medium business or scanning professional the Hewlett Packard ScanJet 6250C was one of the top performers.

Setting up the USB ScanJet 6250C was a simple process, which again only really involved installing the supplied software from the CD, attaching the scanner, rebooting and loading the driver. If you prefer, the HP ScanJet 6250C can be supplied with a SCSI interface.

The scanning surface caters for documents slightly larger than an A4 page. Internally the scanner is 36-bit for colour documents, while greyscale documents are scanned at 12-bit. On the front of the HP ScanJet 6250C there is a green button that is used to call up a quick menu for directing scans, and in conjunction with the excellent TWAIN driver the 6250C is both simple to use, while offering plenty of features and flexibility.

The performance of the HP ScanJet 6250C was excellent all round, with some very good times posted in the speed tests, while also offering very good quality. In the 150dpi colour test the HP ScanJet 6250C came in second just behind the Agfa DuoScan T1200, by just one second. The 300dpi colour test put the HP ScanJet 6250C under considerably more load, but it stayed in the top five with a fourth placing.

The quality of the scans we received during testing were excellent, with sharp straight lines, good depth and accurate representation of the originals.

There is little on which to fault the HP ScanJet 6250C, except maybe for the price: quite steep at $1036. If however you need a robust scanner that offers exceptional quali-

HP ScanJet 4100C	Webstar 19236-EPP	Webstar 9636	Microtek Scanmaker X6
Hewlett-Packard Australia	Innovision Technology	Innovision Technology	Proscan Australia
31-41 Joseph Street	174 Corio Street	174 Corio Street	P.O. Box 700
Blackburn 3130	Shepparton 3630	Shepparton 3630	Neutral Bay 2089
1800 339 862	03 5831 8833	03 5831 8833	1800 654 930
03 9898 6466	03 5831 8844	03 5831 8844	02 9904 1099
www.hp.com.au	www.innovision.com.au	www.innovision.com.au	www.proscan.com.au
$307	$299	$199	$479 USB, $439 EPP, $529 SCSI
1 year	1 year	1 year	1 year
300x600	600x1200	300x600	600x1200
1200	19,200	9600	9600
1	1	1	1
216x297	290x212	216x292	215x297
36-bit	36-bit	N/A	12-bit
USB	Parallel	Parallel	USB, Parallel, SCSI
No	No	No	No
Adobe Photo Deluxe Image Editor	MrScan Twain driver, Xerox TextBridge OCR, MGI Photosuite SE, PaperCom Document Manager	TextBridge, iPhoto Plus 1.2, iPhoto Plus 4	Microtek ScanWizard, Microtek ScanSuite, Ulead PhotoImpact, UleadPhoto Assist, Caere Omni Page LE,DocuMagix PaperMaster, Adobe Acrobat, Color IT
85x465x284	76x419x260	85.5x299x439	292x81x439

ty and functionality then the HP ScanJet 6250C is a scanner really worth considering, especially as the ADF can really save you time.

HP ScanJet 6250C

HP ScanJet 6250C. Price $1036 (as tested). Hewlett-Packard Australia. Ph. 13 13 47. Fax: 03 9898 1968; www.hp.com.au

Innovision Technology

Webstar 9636 & Webstar 19236-EPP

These are the first Webstar scanners we have seen, though our tests found them easily keeping up with the rest of the pack. The Webstar 9636 and Webstar 19236-EPP cost $199 and $299 respectively, which puts them in the mid- to low-end range of scanners in terms of price, while offering similar features.

In terms of technical specification the Webstar 9636 is a 300 x 600 optical scanner, while the Webstar 19236-EPP is an improved 600 x 1200dpi optical resolution scanner.

The scan area of both units is large enough to handle A4-sized documents, and feature hinged covers for books or magazines. These scanners are no weightier than others of the same physical size, thus making them easy to move around if needed. We found the setup a simple matter with each scanner being detected by our test bed and all the software coming from the CD. The TWAIN driver for each scanner was a compact and simple affair, with all the right buttons and options presented for easy scanning operation. More advanced features are available if you need to make any adjustments.

The performance of the Webstar scanners was nothing special, but it was satisfactory for the majority of tasks. In the colour 150dpi test the two Webstar scanners posted almost identical times, 42.5 and 43 seconds. At 300dpi the Webstar 9636 did very well coming in with a time of 64 seconds, which put it mid-field. On the other hand, the Webstar 19236-EPP suffered up the load and produced a time of 88.5 seconds.

The quality of the scans produced by these units

Webstar 9636 & 19236-EPP

Microtek Scanmaker X6

was good, but some darkish areas were detected in the colour test pages. Optical capacity was also good, but some greying at the edges occurred on the straight lines.

Overall the Webstar scanners performed as you would expect for fist time entrants. With some general improvements around the edges, and beefing up the TWAIN driver, the Test Lab feels you could expect even better things from the Webstar range.

Webstar 9636 & Webstar 19236-EPP. Price: $199 (as tested), $299 (as tested); Innovision Technology. Ph: 03 5831 8833, Fax: 03 5831 8844; www.innovision.com.au

Proscan Australia

Microtek Scanmaker X6

At $479 the Microtek Scanmaker X6 represents a fair deal with its price solidly backed by good quality, fast 300dpi colour scans. Aimed at the small business or home markets the Scanmaker X6 was not only simple to install, but its default TWAIN driver settings mean users can expect good results from the first scan.

The process of installing the Scanmaker X6 was very simple indeed, with the software and drivers coming from the supplied CD. The hardware was detected immediately after it was plugged into our test machine and within five minutes we were up and running. A slim but well laid-out printed manual guides you through the steps to getting your scanner up and running.

Another manual includes information on using the excellent TWAIN driver, which was not only a breeze to use but had its share of high level options for those that need extra control. All major functions are presented on a single screen—the image type to be scanned and the resolution—and, as previously mentioned, the defaults were good enough to produce very good quality scans. The software bundled with the scanner, is quite good and includes Ulead PhotoImpact, Ulead Photo Assist, Caere Omni Page LE, DocuMagix PaperMaster, Adobe Acrobat.

As far as testing was concerned the Scanmaker X6 equipped itself quite well, with colour accuracy that was better than average and scan times that ranked it third at 300dpi although at 150dpi it dropped back to ninth place.

Its handling of greyscale images was again better than average, but it was outclassed by all of the other competitors as far as greyscale scan speed was concerned. In fact the fastest scanner in the 300dpi greyscale test was over three times quicker.

If you need a scanner that is quick in colour at higher dpis and you don't want to fiddle endlessly with the TWAIN driver to get colourful and well balanced images then the Scanmaker X6 may be worth your consideration. However, the price is quite high compared to some of the competition, even with the software bundle, and the slow greyscale scans could be a concern.

Microtek Scanmaker X6. Price: $479 USB (as tested) [$439 EPP, $529 SCSI]; Proscan Australia. Ph: 1800 654 930, Fax: 02 9904 1099, www.proscan.com.au

Umax

Umax Astra 1220U and 1220P

The Umax Technologies' Astra 1220U and 1220P are compact, easy to install, and some of the most affordable scanners bearing the Umax name. Their prices put them around that of the HP 4100C, making them excellent value. The only quibble we had were the slowish scan times, but all things considered they were great little packages.

Getting each of the scanners set up was not a difficult process with good documentation providing a step by step approach. Each scanner was recognised at startup as a Plug and Play device, with the drivers and other software being installed very simply. The scanning surface of each scanner is a similar size to many of the other scanners reviewed with a surface area of 216mm by 297mm. As a consequence, the scanner has a diminutive footprint making it a good combination for the small-office or home desktop. It comes with a shipping lock for its delicate scanning optics and the parallel scanner has pass-through for connecting your printer. The TWAIN driver supplied with the Umax scanners was simple and very effective and above all very easy to use.

Although the Umax Astra 1220U and 1220P scanners produced rich, colourful scans and crisp, sharp text, they were not as swift as many of the other scanners reviewed. Suprisingly, the parallel port scanner outshone the USB scanner in a few of the tests, while in all cases we felt the USB scanner was a touch slow.

In the colour tests, the Umax Astra 1220P came in with a time of 41 seconds, the USB 44 seconds. A three-second gap also separated the two scanners at 300dpi, with the parallel port scanner again coming out the victor.

A healthy software bundle makes the 1220U and 1220P fairly good value scanners. They include, for example, Adobe's PhotoDeluxe, Presto PageManager, Presto PhotoAlbum and Omnipage OCR. Although the Astra 1220U and 1220P isn't the most power packaged around , they do provide a lot of scanning power at a reasonable price. With good optical resolutions, deep-colour scanning with a serviceable software bundle there are only a few rough edges, like the speed of the USB version.

UMAX Astra 1220U and 1220P. Price $329 (USB as tested), $270 (Parallel as tested) Computer Enterprises of Australia. Ph 02 9807 5222; Fax 02 9807 5333; www.cea.net.au

Umax Astra 1220U and 1220P

How long are you waiting for your first page?

The OKIPAGE 20N – OKI's new 20-page-per-minute networkable printer – delivers your first page in only seven seconds. Which is remarkable when you realise that it costs less than many 16-page-per-minute machines. And with its 1200 dpi class, optional duplex capability and OKILAN 510E network interface card, we think you'll agree that the OKIPAGE 20N offers unbeatable value.

For further information, please call **1800 800 140** for your nearest supplier or visit our website at **www.oki.com.au**

OKI

People to People Technology

MONOCHROME LaserPrinters

By James Tod

Inkjet printers may have lasers on the run in terms of market share, but if you need raw speed, lots of copies, and are happy with black-and-white output, a laser printer is still the way to go. The cost per printed page is much more attractive and though inkjets are becoming faster, lasers still deliver a speed advantage.

In fact, entry-level laser printers are getting faster. The 4ppm engine speed of the typical entry-level laser two years ago gave way to the 6ppm unit last year. This time around, most new personal lasers come equipped with an 8ppm or faster engine.

In addition to speed, most lasers also offer better paper handling than inkjets, as well as higher monthly duty cycles, which makes them better for high-throughput business environments. And of course, laser output is still the standard by which monochrome text is judged.

For this review, we take a look at monochrome laser printers in two categories: those with an RRP under $1500, and those priced between $1500 and $3000.

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Brother International Australia

Brother HL-1040 & HL-1050 & HL-1070

Brother International Corporation has recently released a number of new laser printers, three of which came to the Lab for review. The HL-1040, HL-1050, and HL-1070 all feature the latest in Brother development and from our tests show they have the performance to really impress. The printers were only let down by poorer quality output in the graphics tests, but otherwise could not be faulted.

Brother HL-1040

The HL-1040 is the baby of the group, but its overall speed, price and quality make it much more than a low-end printer. Featuring a 600 x 600 resolution and 2MB of RAM, the Brother HL-1040 is designed to fill a role as a home or small business printer. It can handle 200 sheets in its multipurpose tray and has room for 100 sheets in the output tray. Providing the processing power is a Motorola MC68EC000 microprocessor running at 16MHz, which managed to provide enough kick for the printer to reach its rated 10 page per minute output speed. The consumables with each of the printers are identical and feature a 2400-page capacity at five percent coverage (though the starter cartridge is rated at only 1000 pages at five percent).

The drum should be replaced at 20,000 pages if you are doing jobs of 20 pages each time; if you're only doing 1-page jobs, the rated drum life is 8000 pages. The overall size and footprint of the Brother HL-1040 is appealing as it is quite small and light.

The are few big differences between the HL-1040 and HL-1050—they weight and behave the same. Inside the printer, however, the HL-1050 comes with an extra 2MB of RAM and provides an improved maximum resolution of 600 x 1200.

The process for setting up the printer is the same for all three units—a great manual guides you through should you need assistance. The driver and associated software is supplied on disks, which we dutifully fed into the computer system when asked.

An early check of the results showed that the extra memory did not help in our tests, but as we only ran the tests at 600 x 600 we did not expect to see any significant improvement. Of course if you bump the job to 600 x 1200 you can expect the extra memory to be very useful.

Jumping to the Brother HL-1070 is a jump to greater functionality, though the internals identical to that of the HL-1050. The difference between the two printers is the inclusion of a second paper bin and a multipurpose tray.

After all the results were tabulated we found that the Brother printers had done very well. In the 10-page Word text test, the HL-1040 and HL-1050 had managed a 7.1ppm rating. The HL-1070 was a little slower at 6.5ppm. In the complex word test the HL-1040 was again the fastest of the Brother printers with a 5.5ppm, this was followed by 4.9ppm for the HL-1050 and 4.6 for the HL-1070.

Where the Brother printers really shines is in the Photo Paint test, where all three came back with ratings of 2.1 pages per minute. In the PDF test, the HL series also managed excellent scores coming in second to the HP LaserJet 4050. The final test again showed speedy times recorded for each of the Brother printers.

Overall the speed of these printers cannot be faulted, but the quality of graphic output was not up to that of the others we looked at. Distinct banding occurred in the graphic test with patches within the image quite evident. This problem did not translate to the Excel graphs we printed, but it is an issue nonetheless.

Brother will no doubt resolve the graphic image issues with print engine development and some driver modification, but in all other respects they have built very good little laser printers that would suit a large section of the community. For the price, $852, the HL-1050 is an excellent proposition with the other two also representing very good buys.

Brother HL-1040, HL-1050, HL-1070. Price (as tested): $639 (HL-1040), $852 (HL-1050), $1065 (HL-1070). Brother International Australia. Ph: 02 9887 4344, Fax: 02 9870 7134; www.brother.com

Brother HL-1050

Brother HL-1070

Canon Australia
LBP-600

With its very compact footprint the LBP-600 was one of the smaller printers reviewed and while it was not the speediest printer on the block it is one of the cheapest at just $599. For your money you get a six page per minute, 600dpi GDI printer. The PC you connect the printer to does all the processing, so if you've got a fast system you can expect very fast throughput.

Getting the LBP-600 setup was not difficult and the driver is nicely polished and offers plenty of scope for modification if you need it. Within the LBP-600 Canon has incorporated a new technology called Automatic Image Refinement (AIR) so that the LBP-660 theoretically produces the equivalent of 2400 dpi on the horizontal axis for finer edge definition. This also helps in providing better-looking greyscales: you can choose a number of different dither patterns including, coarse for simple graphics, a mid-level pattern, or a highly detailed matrix for complex photographic reproduction.

The LBP-600 features very few moving parts and its on-demand fuser means you get almost instant printing. In standby mode the LBP-600 uses only three watts of power. For those with a Windows compatible sound card, audio prompting is available which keeps you appraised of what is going on with the printer. Another of the more interesting features of this printer is called form overlays. This allows users to automatically add company details and other graphic images directly to documents as they are printed.

With the printer ready to go, we moved on to testing and, as we expected, the LBP-600 lived up to its 6ppm speed rating. In the simple Word test a 5.3ppm rating was achieved by the LBP-600 and this was followed by a strong 4.0ppm in the more complex document. In Photo Paint we saw the speed drop to 1.4ppm while in Adobe Acrobat the LBP-600 managed a 1.9ppm rating.

In the final test the little Canon LBP-600 managed a speed rating of 4.5 pages per minute. In terms of quality the LBP-600 was very good, with the AIR system really doing a great job of smoothing edges and helping with graphics. This was most evident in the PDF and Photo Paint tests, where our panel of judges had graphics as well as text to look at.

With sharp quality, great price and good documentation this is an attractive printer. Sure it is designed for low-end work, but it does much more than a low-end job.

LBP-600. Price $599 (as tested). Canon Australia. Ph: 02 9956 883, Fax: 02 9956 8865; www.canon.com.au

Canon LBP-600

GCC Technologies
Elite 12/600 & Elite XL20/600

We received two printers from GCC Technolgoes, the Elite 12/600 and Elite XL20/600. From the name you can glean that they are both 600dpi capable printers with one being rated at 12 pages per minute, while the other is rated at 20 pages per minute. These printers, despite being more costly than equally specified competitors printers, do compensate the purchaser with a warranty that guarantees an exchange of the printer next business day if you have trouble. Other than this, the difference between these two printers and those from other manufacturers is cosmetic.

The Elite 12/600 is a 600 x 600dpi printer that uses an AMD 29040 processor running at 50MHz to power its engine. Coming standard with 8MB of RAM and Postscript Level 2 is very good and would thus suit higher-end work from drawing packages such as CorelDRAW and the like. For our tests we only used the Parallel port, but the Elite 12/600 can be kitted out with a 10-Base T Ethernet card for connection to a network. One slightly limiting factor was the size of the paper input tray which can only handle 250 pages, but there is a multipurpose tray that can handle 80 pages. If your business needs require the printing of envelopes then the Elite 12/600 can handle Comm 10, C5, DL and Monarch sizes. The toner cartridge will print 6000 pages at five percent coverage and costs $207 to replace. Those with big printing requirements should feel happy with the Elite 12/600's 20,000 page duty cycle.

With a rated print speed of 20 pages per minute the Elite XL 20/600 is a printer designed for the medium to larger business offices. Like the Elite 12/600, it comes with a one-year Next Business Day replacement warranty. The maximum resolution of the Elite XL 20/600 is 600 x 600, which puts it below the less speedy offerings reviewed here, but nonetheless still provided very good print quality. AMD provides the processor for the Elite XL 20/600, which matches that of the Elite 12/600.

Standard in the XL 20/600 is 16MB of RAM as well as Postscript Level 2. One of the other advantages of the XL 20/600 is its ability to handle A3 sized paper, and for those even bigger jobs you can use banner paper with a size of 330 x 900 mm. Also boosted on the XL 20/600 is the paper capacity with the main paper

Elite 12/600

tray being able to handle 500 sheets of paper, while the multipurpose tray will handle 150 sheets. As you would expect, the toner cartridge is a little larger than that of the Elite 12/600 and can print 14,000 pages at five percent coverage. With a replacement cost of just $345 the cost per page of this particular printer is excellent.

Both the printers we received from GCC Technologies performed as you would expect for printers using Postrscript Level 2 emulation, and as a result on paper look slower than they should. The tradeoff with using Postscript Level 2, however, is that in graphics jobs you can expect better quality, which we did see, but print times are extended as a result. Nevertheless, the Elite XL 20/600 managed a very respectable 15.8ppm rating in the simple Word test, while the Elite 12/600 scored an 8.5ppm. In the Photo Paint test the printers were slowed markedly, both achieving only 1ppm. The result in the PDF test was improved with both printers posting solid scores. In the final test the graphs in our Excel test again slowed the printers more than the others as they have to chug through the additional information used to process a Postscript job.

As the print jobs were handled using Postscript, the quality of all the jobs was excellent, with sharp, clean, and dark text and lines. The graphic test also showed high quality with smooth greyscale transitions in the various images within the file.

For the business user who wants real warranty security, the Elite range of printers should be very comforting. Of course you also receive a good quality printer that offers good cost per page statistics and good quality printouts.

Elite 12/600 & Elite XL 20/600. Price $1999 (12/600), $3534 (XL 20/600). GCC Technologies. Ph: 03 9562 1800 or 1800 422 832. Fax: 03 9562 1900; www.gcctech .com/australia

Elite XL20/600

Hewlett-Packard

HP LaserJet 1100A

Designed for the small office or home office, the HP LaserJet 1100A is not only a very competent laser printer, but is a scanner as well. The HP LaserJet 1100A delivers eight pages per minute and provides 600 dpi print resolution with HP's Resolution Enhancement technology (REt). With a price of $1036 this is a great little printer that offers speedy throughput, excellent quality and scanning as well.

The HP LaserJet 1100A comes standard with 2MB standard memory, which is plenty for most applications. If you need to print more complex work then you can also expand the memory to 18MB.

Setting up was simple and support for many of the major operating systems including Windows 3.1, 3.11, 95, 98, NT 4.0, OS/2 and DOS is provided. You can even hook the printer up to a network via the optional HP JetDirect External Print server.

The technology that allows the addition of the scanning hardware is called HP JetPath technology and is code designed into the firmware, hardware and software to allow the HP range of printers to take on additional capabilities and improve functionality quickly and easily. Automated scanning and copying can be achieved using the 20-page auto feed bin. The paper tray of the HP 1100A has a capacity of 125 sheets with an improved paper flow, making it almost foolproof for the delivery of the stock. Some other nifty features of the 1100A's driver are manual duplexing and N-up printing, which can print up to nine thumbnail pages per sheet.

HP LaserJet 1100A

The performance of the HP 1100A was very good. In the simple Word test it managed a 7.1ppm rating, while in the more complex document it managed a very respectable 3.9ppm. In the harder Photo Paint test the HP 1100A did very well ranking alongside some of the classier competition with a rating of 1.5ppm. The PDF test showed the HP 1100A also had a good turn of speed with a 1.0ppm rating, again matching some of the faster printers. In the final speed test the HP 1100A scored 3.9ppm. As we expected, the quality of the HP 1100A was very good with sharp text and very good greys in the graphics test. The PDF test did stretch its PCL capabilities a little with some jaggies, but overall it was still very good.

Overall, HP has again managed to produce an excellent printer, with good performance and a reasonable price. The fact that you can add a scanner to the mix just

SUMMARY OF FEATURES

Monochrome Laser Printers

PC MAGAZINE AUSTRALIA MERIT AWARD

Product name	Elite 12/600	Elite XL20/600	HL-1040	HL-1050
Supplier name	GCC Technologies	GCC Technologies	Brother International	Brother International
Address	5/585 Blackburn Road Notting Hill 3168	5/585 Blackburn Road Notting Hill 3168	7 Khartoum Road North Ryde 2113	7 Khartoum Road North Ryde 2113
Phone number	03 9562 1800 1800 422 832	03 9562 1800 1800 422 832	02 9887 4344	02 9887 4344
Fax number	03 9562 1900	03 9562 1900	02 9870 7234	02 9870 7234
Web address	www.gcctech.com/australia	www.gcctech.com/australia	www.brother.com	www.brother.com
Price (inc. tax)	$1999	$3534	$639	$852
Warranty	Platinum Exchange (1 year, next business day replacement)	Platinum Exchange (1 year next business day replacement)	1 year RTB	1 year RTB
Maximum resolution (DPI)	600x600	600x600	600x600	1200x600
Manufacturer rated printing speed	12ppm	20ppm	10ppm	10ppm
CPU	AMD 29040 @ 50MHz (Dual Channel)	AMD 29040 @ 50MHz (Dual Channel)	MC68EC000 @ 16MHz	MB86831 (Fuj. SPARClite) @ 66MHz
RAM fitted to test printer	8MB	16MB	2MB	4MB
Standard/maximum RAM and type	8MB/ 64MB	16MB/64MB	2MB/2MB	4MB/36MB
Emulation/printer languages	PCL5, HP-GL2, Postscript Level 2	PCL5, HP-GL/2, Postscript Level 2	PCL4, PCL5, Epson FX-850, IBM Proprinter XL	PCL6, EPSON FX-850, IBM Proprinter XL
Automatic emulation switching	Yes	Yes	Yes	Yes
Interfaces standard (optional)	Bi-directional parallel, LocalTalk/ RS-422,TCP/IP, Ethertalk 10BASE-T	Bi-directional parallel, LocalTalk/ RS-422, HDI-30 SCSI, 10BASE-T, AAVI	Bi-directional parallel, RS-422A/ RS-232C	Bi-directional parallel, USB, RS-422A/ RS-232C
Fonts: bitmapped/scalable/PS	15 PCL, 80 PS (35 built in)	15 PCL, 250 downloadable, 35 PS	24/ 35/ N/A	12/ 49/ N/A
Paper sizes supported	A4, B5, Executive, Legal, Letter, 216x356	A3, A4, B4, B5, Executive, Ledger, Legal,Letter, Statement, Banner 330 x 900,320 x 892	A4, A5, B5, Executive, Legal, Letter 69.85-215.9 x 12-355.6	A4, A5, B5, Executive, Legal, Letter 69.85-215.9 x 127-355.6
Envelope sizes supported	Comm 10, C5, DL, Monarch	Comm 10, C5, DL, Monarch	Comm 10 C4, DL, Monarch 288.6 x 304.8	Comm 10, C4, DL, Monarch 288.6 x 304.8
Input trays size/capacity	A4/ 250, 80 multipurpose	A3+/ 500, 150 multipurpose	A4/ 200 multipurpose	A4/ 200 multipurpose + manual feed slot
Output tray cap. facedown/faceup	250 facedown	500 facedown	100 facedown	100 facedown
Toner life pages/ replacement cost	6000/ $207	14,000/ $345	2400/ new toner cartridge1,000/ starter toner cartridge/ N/A	2400/ new toner cartridge 1000/ starter toner cartridge/ N/A
Drum life pages/ replacement cost	6000/ $207	14,000/ $345	20,000 @ 20 pages per job 8,000 @ 1 page per job/ N/A	20,000 @ 20 pages per job 8,000 @ 1 page per job/ N/A
Manufacturer rated cost per page	3.45 cents	2.46 cents	4 cents	4 cents
Duty cycle (pages/month)	20,000	50,000	5000	5000
Print Engine Manufacturer	Fuji Xerox P893	Fuji Xerox P880	Brother International	Brother International
Dimensions (HxWxD in mm)	228x421x415	412.5x579.6x601.5	245x390x365	245x390x365
Weight (kg)	12.2	26.5	7.2	7.2

improves things even more, making this unit very highly recommended.

HP LaserJet 1100A. Price $1036 (as tested). Hewlett-Packard Australia. Ph: 13 13 47. Fax: 03 9898 1968; www.hp.com.au

Hewlett-Packard

HP LaserJet 2100TN

The HP LaserJet 2100TN is designed for small workgroups or office environments that have advanced printing needs. Offering true 1200 x 1200 dpi output, 8MB of RAM, 600-sheet input capacity (two 250-sheet and one 100-sheet trays), HP PostScript emulation and the HP JetDirect 600N (EIO) 10Base-T print server, the HP 2100TN is a great little package.

Setup was simple: we just plugged in the hardware, loaded up the CD and we were in business. We had everything up and running in about ten minutes without having to consult the documentation. If you are not familiar with setting up printers the supplied manuals and guides are an excellent aid.

Other features of this particular printer include the 10-page-per-minute rated print speed, and instant-on fuser. A fast 4Mbps IrDA-compliant infrared port allows point-and-print wireless printing from portable PCs. We were impressed with the new 4000 series printer we reviewed last year, and the tradition continues with an impromptu network test revealing just how much easier it is to get the printer hooked up to a network these days. Of importance to business users will also be the 15,000-page monthly duty cycle and 5000 page capacity toner cartridge.

www.zdnet.com.au

Monochrome Lasers

			PC MAGAZINE AUSTRALIA EDITOR'S CHOICE	PC MAGAZINE AUSTRALIA MERIT AWARD
HL-1070	**HP LaserJet 1100A**	**HP 2100TN**	**HP 4050**	**LBP-600**
Brother International	Hewlett-Packard Australia	Hewlett-Packard Australia	Hewlett-Packard Australia	Canon Australia
7 Khartoum Road	31-41 Joseph Street	31-41 Joseph Street	31-41 Joseph Street	1 Thomas Holt Drive
North Ryde 2113	Blackburn 3130	Blackburn 3130	Blackburn 3130	North Ryde 2113
02 9887 4344	1800 339 862	1800 339 862	1800 339 862	02 9805 2000
02 9870 7234	03 9898 6466	03 9898 6466	03 9898 6466	02 9805 0168
www.brother.com	www.hp.com	www.hp.com	www.hp.com	www.canon.com.au
$1065	$1036	$2039	$2481	$599
1 year RTB	1 year	1 year	1 year	3 year (optional)
1200x600	600x600	1200x1200	1200x1200	600x600 or 600x1200 with font smoothing
10ppm	8ppm	10ppm	16ppm	6ppm
MB86831 (Fuj. SPARClite) @ 66MHz	N/A	66MHz	133MHz	Host dependent
4MB	2MB	8MB	8MB	128KB
4MB/36MB	2MB/18MB	8MB/40MB	8MB/200MB	128KB/128KB
PCL6, EPSON FX-850, IBM Proprinter XL	PCL5e	PCL6, Postscript Level 2	PCL6, Postscript Level 2, PCL5e	PCL4
Yes	N/A	Yes	Yes	Yes - DOS applications only
Bi-directional parallel, USB, RS-422A/ RS-232C	Bi-directional parallel	Bi-directional parallel, USB	Bi-directional parallel, LocalTalk/ RS-422, RS-422A/ RS-232C	Bi-directional Parallel
17/ 75/ 66	26 Intelli fonts	80 device fonts, 65 true type	110 True Type, HP font smart	22 True Type, 19 PCL
A4, A5, A6, B5, Executive, Legal, Letter 69.85-215.9 x 127-355.6	A4, Executive, Legal Letter	A4, A5, B5, Custom, Executive, Legal, Letter	A4, A5, B5, Custom, Executive, Legal, Letter	A4, B5, Executive, Index Card, Legal, Letter
Comm 10, C4, DL, Monarch 288.6 x 304.8	Comm 10, C5, DL, Monarch	Comm 10, C5, DL, Monarch	Comm 10, C5, DL, Monarch	Comm 10, C5, DL, Monarch
A4/ 200 multipurpose + manual feed slot	A4/ 125	A4 / 350	A4/ Std 600, Max 1000	A4/ 100 + manual feed slot
100 facedown	100 facedown	150 facedown	N/A	50 faceup, 50 facedown
2400 / new toner cartridge1,000 / starter toner cartridge/ N/A	2500/ $105	5000/ $170	10,000/ $270	3000/ $140
20,000 @ 20 pages per job 8,000 @ 1 page per job/ N/A	N/A	N/A	N/A	N/A
4 cents	4 cents	3-4 cents	2 cents	5 cents
5000	7000	15,000	65,000	N/A
Brother International	N/A	N/A	N/A	Canon
274x402x439	378x367x325	309x406x420	346x390x493	249x321x336
9.6	7.3	14.4	18.2	7

The performance of the HP Laserjet 2100TN is as you would expect for a 10-page-per-minute printer. In the 10-page Word test it achieved an 8.5-pages-per-minute rating which matched the faster-rated 12-page-per-minute printer from Elite.

In the more complex Word document test the HP LaserJet 2100TN again did very well producing one of the fastest times. The Photo Paint test put the printer under a bit of pressure as it only managed a 1.4ppm rating. In the second last test the result was much the same with a 1.1ppm result. In the final test, the HP LaserJet 2100TN produced a very respectable 6.7 pages per minute.

With a $2039 dollar price tag the HP LaserJet 2100TN is a very good deal. It features excellent print quality, very fast print times overall and above all HP style, quality and reliability. If these are the sorts of qualities that appeal to you then you should also be impressed with this particular laser printer.

HP LaserJet 2100TN. Price: $2039 (as tested). Hewlett-Packard Australia. Ph: 13 13 47, Fax: 03 9898 1968; www.hp.com.au

Hewlett-Packard

HP LaserJet 4050

The HP LaserJet 4050 is brand new—so new, in fact, that it arrived at the Lab with no badges or documentation. We had to print a configuration page to identify the printer. Like others in the HP range the 4050 features a significant weigh reduction, narrower profile and a more stylish appearance than its venerable old counterpart the HP LaserJet 4. With a rated speed of 16 pages

SUMMARY OF FEATURES

Monochrome Laser Printers

PC MAGAZINE AUSTRALIA EDITOR'S CHOICE

Product name	Minolta Page Pro 20	OKIPAGE 20n	Optra K 1220
Supplier name	Star Micronics	IPL Datron Group	Lexmark International
Address	Unit A, 107 Asquith Street Silverwater 2128	63-85 Victoria Street Alexandria 2015	12A Rodborough Road Frenchs Forest NSW 2086
Phone number	02 9748 4300	02 9698 6211	02 9930 3555
Fax number	02 9748 3527	02 9698 4043	02 9930 3553
Web address	www.minoltaprinters.com	www.oki.com.au	www.lexmark.com
Price(inc. tax)	$2537	$2438	$1360
Warranty	1 year on site	Optional 2-3 years on-site/2-3 years RTB	1 year
Maximum resolution (DPI)	600x600	600x1200	600x600
Manufacturer rated printing speed	20ppm	20ppm	12ppm
CPU	NR4645 @ 100MHz	RISC MIPS R3000	Intel 80960JF @ 33MHz
RAM fitted to test printer	4MB	4MB	2MB
Standard/maximum RAM and Type	4MB/68MB	4MB/68MB	2MB/66MB
Emulation/printer languages	PCL5e, HP-GL/2, Postscript Level 2 (opt)	PCL6, IBM Proprinter XL, Epson FX	Postscript Level 2, PCL6
Automatic emulation switching	Yes	Yes	Yes
Interfaces standard (optional)	Bi-directional parallel, 10BASE-T	Bi-directional parallel, RS232C, 10BASE-T	Bi-directional parallel, RS-422A/ RS232C,Ethernet, Token Ring
Fonts: bitmapped/scalable/PS	6/ 45/ 35	1/ 45/ true Adobe postscript	2/ 75/ 75
Paper sizes supported	A3, A4, A5, B4, B5, Executive, Ledger, Legal, Letter	A4, A5, A6, B5, Executive, Legal, Letter	A4, A5, B5, Executive, Legal, Letter
Envelope sizes supported	Comm 10, C5, DL, Monarch	Comm 10, C5, DL, Monarch	Comm 10, C5, DL, Monarch
Standard input trays size/capacity	Tray 1: A3+/ 150 Tray 2: A4/ 500 Optional: 250 sheet tray for all supported paper sizes, Tray 3 with either 500 sheet A4 cassette or 250 sheet universal tray, Duplex unit	A4/ 530, 100 multipurpose	A4/ 200
Output tray capacity facedown/faceup	500 facedown	250/ facedown, 100/ faceup	200/ facedown, 20/ faceup
Toner life pages/replacement cost	10,000/ $264.60	6000/ $59	5000/ $175
Drum life pages/replacement cost	N/A	30,000/ $439	32,500/ $420
Manufacturer rated cost per page	3.3 cents	N/A	4.8 cents
Duty cycle (pages/month)	6000	50,000	15,000
Print engine manufacturer	Minolta	N/A	N/A
Dimensions (HxWxD in mm)	403x545x383	331x366x462	286x402x414
Weight (kg)	26	19	17

per minute the HP LaserJet 4050 is aimed at small- to medium-sized businesses, with an eye for keen pricing and solid reliability. Naturally the HP LaserJet 4050 also performed very well in our quality tests offering some of the highest quality we saw from the printers reviewed.

HP LaserJet 2100TN

We had to download all the software— both drivers and administration programs— from the net because no CD was sent with the printer. But configuring the printer is one of the easiest tasks ever thanks to the menu systems. Each of the four buttons used to access the printer's features is clearly labelled. And the LCD display is backlit making it very easy to read the option currently selected. Overall, we felt that HP LaserJet 4050 earned top honours in the setup and monitoring stakes, with unsurpassed software and hardware design. For a while it seemed printers would offer no more than 250 or 500 page input cassettes, but that has changed with the HP LaserJet 4050 now offering up to 1100 sheets input. The base printer comes standard with a 600 sheet capacity.

Our test prints revealed that the HP LaserJet 4050 fell slightly behind its rated print speed of 16ppm at 600dpi, achieving a speed of around 13 pages per minute in our simple Word document

HP LaserJet 4050

test. The HP LaserJet 4050 uses a 133MHz processor to provide its processing power and this did help it achieve the fastest times in three out of five tests. The speed of the HP 4050 fell to around nine pages a minute in our more complex word document, with only the 20ppm OkiPage 20N and Elite XL/20 doing any better. In other tests the HP LaserJet 4050 performed above average, and in fact came out on top in the PDF and Excel test. In terms of quality the printed output is excellent, with 600 x 600dpi offering excellent greyscale fills and very sharp text. Overall we found both the text and graphics test results were superb, with only two other printers reviewed coming close to offering such high quality output.

In essence the HP LaserJet 4050 is designed to integrate easily into any environment—it looks good, has exceptional administration utilities, and it offers some of the sharpest and highest quality output from any laser printer we have seen. If this is not enough to convince you, then maybe the price of just $2481 will.

Hewlett-Packard LaserJet 4050. Price $2481. Hewlett-Packard Australia. Ph: 13 13 47. Fax: 03 9898 1968; www.hp.com.au

IPL-Datron

OkiPage 20n

In a review we did on network laser printers last year we saw the OkiPage 20n for the first time. Our opinion of this quality printer remains much the same, as it performed very similarly. Designed for a medium-sized business or department with high-end needs, the OkiPage 20n provides plenty of speed and paper-handling finesse to take on big jobs. The performance of the OkiPage 20n for most simple text work is excellent, but as our tests discovered it did not handle more complex work as well.

Setting up the OkiPage 20n was a simple affair; we tested the machine as a standalone printer but it is network cabable should you require this feature. For its speed and features the OkiPage 20n has a relatively small footprint and is also quite light, making moving it around a job for only one person. The OkiPage 20n offers 1200 x 600dpi printing and comes with only 4MB of RAM standard. For more professional use, this can be expanded to 68MB. The paper handling of the OkiPage 20n is an excellent feature of this printer, with a large 530-page cassette supplied as standard, with an additional 530-page cassette available as an optional extra. One hundred pages can be loaded in the multi-purpose tray. Standard on the printer are a parallel and serial port, with a network card an option extra for your 10base-T, 10Base-2 or Token Ring network.

The quality of output in both the text and graphics document tests was very good, but not as good as the HP units. The maximum resolution of 1200 x 600dpi proved more than adequate for general work and the documents we used for evaluation at 600 x 600 were also very good. The speed of the OkiPage 20n was very good when given simple tasks such as printing text. This was proven in the Word text test with an

OkiPage 20n

Editors' Choice

- Under $1500: Lexmark Optra K 1220
- $1500 to $3000: HP LaserJet 4050

With a broad range of products on offer, there is something here for everyone. As a result we have given four awards: an Editors' Choice and two merits in the sub $1500 category, and an Editors Choice in the over $1500 category. The sub-$1500 Editors' Choice goes to the Lexmark Optra K 1220, for its speed, ease of use, driver facilities, cheap running costs and a very reasonable price. The two Merit Awards go to the Canon LBP-660 and Brother HL-1040. The Canon is the least expensive printer tested and even though it's a little slow its graphics quality really was excellent for its class. If graphics quality is not paramount and speed is, for a paltry $40 more the HL-1040 would be your best bet.

The Editors' Choice in the over $1500 category, the HP LaserJet 4050, may not have the highest rated engine speed amongst the group. HP rate it at 16ppm, but it took out three of the five speed test categories. The HP produces excellent quality text and graphics and build quality is what you'd expect from HP.

equal first place along side the Elite XL 20/600. In the complex Word test the OkiPage 20n came in second with an 8.6ppm rating. The power of the OkiPage 20n was then revealed in the Photo Paint test with a first place, but this result is diminished somewhat because a printer costing one quarter the price matched it for speed. The PDF test was where the OkiPage 20n slipped quite badly, coming in with a sub-1ppm result. It redeemed itself in the Excel test with a much better 8.9ppm.

Optra K 1220

The overall OkiPage 20n package is a good one and with a small price drop over the last year it is an even better deal now. While the speed and quality of the printer was matched by the high-end HP printers, the duty cycle and the running costs are quite low. For those that consider a large purchase an important investment, the printer can be bought with a number of different warranty options to suit your requirements.

OkiPage 20n. Price: $2438: IPL-Datron. Ph: 9698 8211. Fax: 02 9698 4043: www.oki.com.au

Lexmark International

Optra K 1220

There is a lot to like about the Optra K 1220 laser printer: it uses a fast Intel 80960JF RISC processor running at 33MHz and comes standard with 2MB of RAM, PCL 6 and PostScript Level 2 emulations, an 18-second first-page-out speed and a top output speed of 12ppm. We can certainly validate its performance and with a price of just $1360 this printer is an excellent deal.

If you buy this printer for a workgroup you can even share it using an optional internal MarkNet S Print server.

Setting up for our test system did not use anything other than the parallel port, which proved very simple. We really liked the installation of the printer driver and associated software with the development time really paying dividends in terms of "ease of management". The software used to manage the printer is called MarkVision and can be used to modify everything from multi-up printing, toner saving and configuring the power save modes.

The Optra K 1220 features a standard 200-sheet input tray, a single sheet manual feeder, a straight-through paper path and a 200-sheet output tray. It also handles printing on an assortment of other office stock such as envelopes and card. If you have really large jobs to process then you can purchase the optional 450-page paper tray, which boosts the maximum capacity substantially. You will find there are printer drivers for a variety of platforms and support for either Ethernet or Token Ring networks. The maximum resolution of the Optra K 1220 is 1200 (Image Quality), while the resolution we used for testing was 600 x 600.

The speed of the Optra K 1220 was very good for a 12-page-per-minute laser printer. In the first test the printer managed a rating of 9.5ppm for the 10-page Word document. The second test revealed another good turn of speed with a 6.5ppm rating posted in the complex 4-page Word document test. While the Photo Paint test did slow the printer to just 1.5ppm it was still quite reasonable as it equalled much faster specified printers. In the quite processing intensive

Laser Printer ppm Performance

Longer bars indicate better performance	Word 10-page text document	Word 4-page text/ graphics document	Photo Paint 1-page TIF file	Adobe Acrobat 1-page PDF file	Excel 4-page text/ graphics document
Brother HL-1040	7.1	5.5	2.1	2.6	6.9
Brother HL-1050	7.1	4.9	2.1	2.5	7.1
Brother HL-1070	6.5	4.6	2.1	2.5	7.1
Canon LBP-660	5.3	4.0	1.4	1.9	4.5
Elite 12/ 600	8.5	2.5	0.9	1.3	6.2
Elite XL 20/600	15.8	3.0	1.0	1.5	8.0
HP LaserJet 1100A	7.1	3.9	1.5	1.0	3.9
HP LaserJet 2100TN	8.5	6.2	1.4	1.1	6.7
HP LaserJet 4050	12.8	8.9	1.8	2.9	10.0
Lexmark Optra K 1220	9.5	6.5	1.5	1.1	6.9
Minolta Page Pro 20	11.1	6.5	1.5	1.9	8.0
OKIPAGE 20N	15.8	8.6	2.1	0.9	8.9

www.zdnet.com.au

HOW WE TESTED

Monochrome Laser Printers

PC MAGAZINE AUSTRALIA EDITORS' CHOICE

We tested each of the printers sent for review on a stand-alone Windows 98 system. Each of the printers' Windows 95/98 drivers were installed on the workstation as per instructions supplied by the vendor or included in the packaging. For the performance tests each printer was set to 600dpi.

For the actual testing, we used Microsoft Word 97, Corel Draw 7.0, Photo Paint 5 and Excel 97. The print jobs consisted of a 10-page single font document done in Word, a 4-page document with multiple fonts, styles, columns and graphic images in Word, a one-page complex Corel Draw image, a large TIF file from Photo Paint and a combined text and graph document from Excel.

To time the jobs, we turned the printer off-line and printed the job from the selected application. This removed the overhead of the workstation from the results. The job was timed from the moment the printer was turned on-line to when the last page of the job hit the output tray.

Printer output was assessed for quality by a panel of lab staff, both with the naked eye and also with an 8x loupe. Purity was also judged with the naked eye, assessing how close the output matched the screen image. While we acknowledge this is a largely subjective process, especially given the different technologies, we feel that most users would use similar purity criteria.

PDF test the Optra K 1220 managed 1.1ppm, and it finished off with a 6.9ppm rating in the final test from Excel. The quality of printing was excellent, with good straight lines and very smooth transitions in the graphics tests. Text was very good even under magnification.

We really like the features, speed and price of this printer. Not only does it match faster printers in the speed tests, but its quality even at 600 x 600 was excellent and therefore great for business and keeping costs low. In the final analysis the overall combination of features, speed, price and low consumables cost gave the Optra K 1220 the Editors' Choice for this review.

Optra K 1220. Price: $1360 (as tested). Lexmark International. Ph: 02 9930 3555. Fax: 02 9930 3553; www.lexmark.com

Star Micronics

Minolta Page Pro 20

The Minolta Page Pro 20 is a very reasonably priced and high-quality laser printer. With a list price of $2537 you are getting a highly featured and well equipped laser for the money, it's just a pity that its speed was not quite as good as it should be. Designed for the medium to large businesses the Minolta Page Pro 20 can be fitted out with a 10 Base-2/T network card if you need this sort of interface.

Minolta Page Pro 20

Installing the Page Pro 20 was a simple process with drivers being supplied on CD. Newer versions of the software can be found on the net if the need arises. Inside the Page Pro 20 is a 100MHz NR4645 processor that enables the Page Pro 20 to maintain its rated print speed. The maximum resolution of the Minolta Page Pro 20 is 600 x 600dpi and with 4MB of RAM installed in the printer there is plenty for most jobs. Those with higher-end print needs may require the optional Postscript Level 2 emulation, as the Page Pro 20 only comes with PCL5. As with the OkiPage, the Minolta can handle A3-sized paper for big jobs. Other special features of the Minolta Page Pro 20 include automatic booklet printing and double-sided printing. The Page Pro 20 uses Minolta's patented toner cartridge that makes the process of changing cartridges very simple indeed. New cartridges cost $264.60 to replace and will print 10,000 pages.

In the performance stakes we found the Minolta a little slower than expected, but still quite reasonable depending on the task. In the simple 10-page Word document test the Minolta Page Pro 20 posted a page per minute rating of 11.1, this fell to 6.5ppm in the more complex Word document test. In Photo Paint and Adobe Acrobat the results were 1.5ppm and 1.9ppm respectively, which puts it alongside many of the other printers reviewed. In the Excel test the Minolta Page Pro 20 perked up a little to 8.0ppm. The quality of the print outs from the Minolta were very good and make up for the slightly poorer performance. We really liked the text sharpness and the greyscale graphics tests were very smooth and well defined.

Overall this printer has a good combination of clever features and good quality.

Page Pro 20. Price: $2537 (as tested). Star Micronics. Ph: 02 9748 4300. Fax: 02 9748 3527; www.minoltaprinters.com

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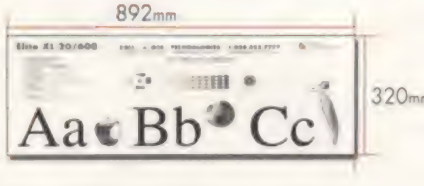

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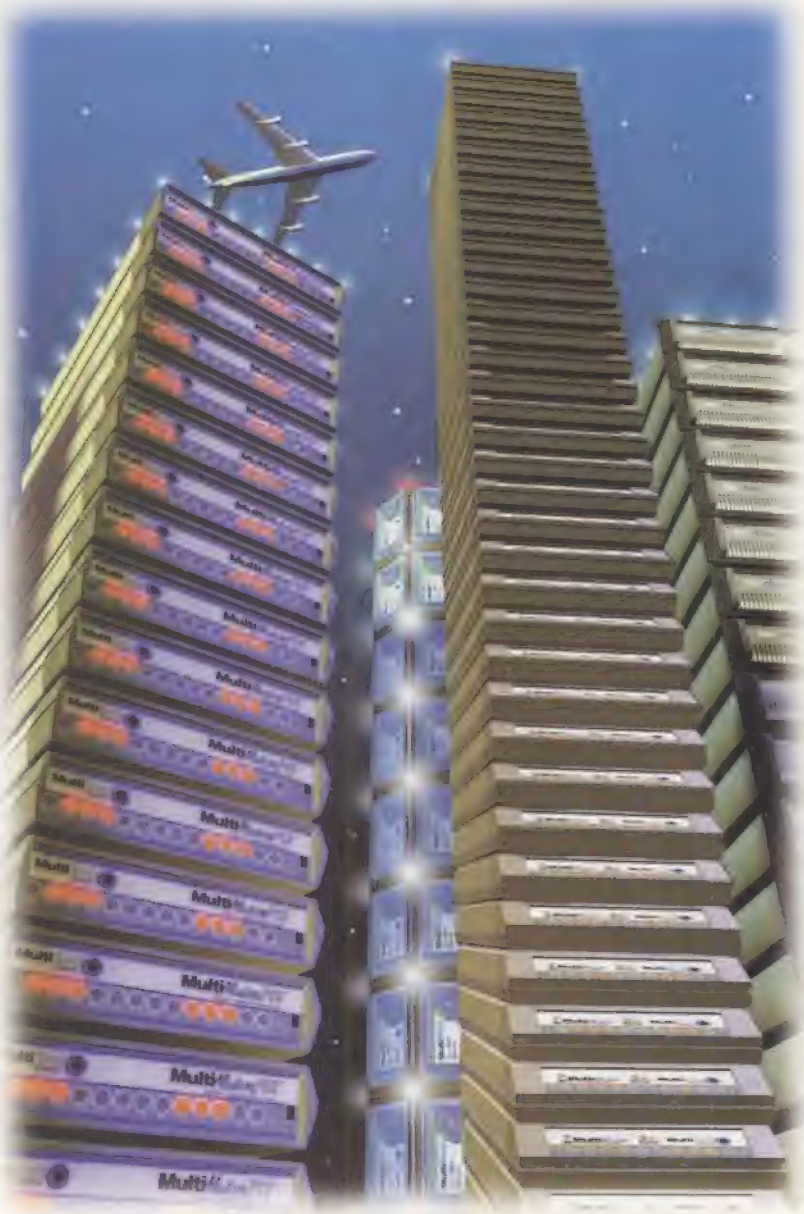

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Cards for all connections

Network interface cards. All of the PC Cards we test here can connect to both Ethernet and Fast Ethernet networks. Though 16-bit cards are suitable for most tasks, only CardBus cards offer sufficient network throughput to tap the true potential of high-speed networking.

These slot-saving LAN-modem cards keep you in constant contact with the office or the Internet.

BY BRUCE BROWN

Modems. With support for the latest 56k standards (V.90 and K56flex), these cards deliver the fastest dial-up connections available for accessing your corporate LAN via a remote-access server, browsing the Web, or checking your e-mail.

AS NOTEBOOK PCS GET THINNER AND LIGHTER, PERIPHERALS ARE ALSO DOING THEIR PART TO cut down on the clutter you need to carry around. Combination PC Cards are a case in point. These credit card–size devices merge the functions of a modem and a network interface card, or NIC, so whether you're at the office or on the road, you need only one device to stay connected to your corporate LAN or browse the Web.

We tested six combination PC Cards that support the latest communications standards including 56kbps modems as well as both Ethernet (10Mbps) and Fast Ethernet (100Mbps) networks. These cards offer several advantages over single-function cards. First, they let you keep a slot open for other devices. The exception is the Xircom RealPort CardBus Ethernet 10/100 + Modem 56, which is a Type III card. Second, these cards offer a single, quick setup routine that installs all you need for modem and network connections. Finally, these cards can reduce the number of cables and dongles that you need to carry.

Compaq Microcom 550 56K Modem + 10/100 Ethernet PC Card 128
IBM 10/100 EtherJet CardBus Adapter with 56K Modem 129
Intel PRO/100 Mobile Adapter LAN + Modem56/32bit CardBus 130
Ositech Jack of Spades CardBus 10/100 + 56K Modem 133
3Com Megahertz 10/100 LAN + 56K Modem PC Card 133
Xircom RealPort CardBus Ethernet 10/100 + Modem 56 137
Editors' Choice 128
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Editors' Hot Links 133

The cards we reviewed fall into two major categories: two of them (from Compaq and 3Com) rely on the original 16-bit PC Card interface; the other four (from IBM, Intel, Ositech, and Xircom) employ the newer, 32-bit interface known as CardBus. The key difference is that CardBus supports speeds of up to 33MHz and has a 32-bit data path, so cards can transfer data much more quickly. Although this has virtually no effect on modem and 10Mbps Ethernet communications, it has a dramatic impact on high-speed networking.

In our Ethernet tests, the 16-bit PC Cards and CardBus cards had average throughput scores of about 5.8Mbps and 6.8Mbps, respectively. But when we switched to Fast Ethernet, the CardBus cards notched an average throughput of 42.8Mbps, while 16-bit cards topped out at 8.3Mbps. In other words, CardBus cards are about five times as fast as 16-bit cards on typical network tasks. In our modem tests, however, the CardBus issue is moot. In fact, the 16-bit card from 3Com was at about 30kbps, approximately 50 percent faster than the rest of the field.

One drawback to CardBus that we discovered during testing is that it automatically assigns the modem to the COM5 port. For applications that support Microsoft's Telephony API (TAPI), this poses no problem. But there are some non-TAPI applications—AOL 4.0, for example—that don't support COM ports greater than COM4. Although you can change these settings in the Windows Registry (we did), most users will find this solution unsuitable. Three of the CardBus vendors (IBM, Intel, and Xircom) provide utilities to help reassign the COM port, if necessary. Regardless, we'd like to see better documentation of this problem and an easier fix.

In addition to CardBus support, the physical design of the card and its cables are a key differentiator. The most innovative design belongs to the Xircom card, which makes good use of its added girth by incorporating standard jacks for RJ-11 and twisted pair RJ-45 cables directly into the card. If you forget your cables, all you need to do is find a standard phone line or network cable and you're back in business. Most others use proprietary dongles or cables.

If your company already has a Fast Ethernet network or is planning to upgrade, or you often perform network-intensive chores such as replicating entire e-mail files or backing up your system, by all means opt for the latest and greatest. If you spend a lot of time on the road, however, you should pay more attention to modem performance. No matter how you work, you'll find a card here that suits your style.

All reviews by Bruce Brown

editors' choice

The 3Com card is a performance leader.

The versatile Ositech card works on PBXs.

- **16-bit: 3Com Megahertz 10/100 LAN 56K Modem PC Card**
- **CardBus: Ositech Jack of Spades CardBus 10/100 + 56K Modem with DPI PC Card**

PC MAGAZINE AUSTRALIA EDITORS' CHOICE

Top-notch performance, reliability, a space-saving and convenient design—all these factors go into a good communications solution. Two cards, the Jack of Spades CardBus 10/100 + 56K Modem with DPI PC Card and the 3Com Megahertz 10/100 LAN + 56K Modem PC Card, possess these qualities, earning our Editors' Choice designation.

The Ositech is a Type II card with a CardBus interface. It uses proprietary cables that plug directly into the edge of the card and works on both analogue and PBX (digital) phone lines. The Ositech produced the fastest throughput on our Ethernet tests (7.7Mbps). The 16-bit 3Com card was the fastest of the 16-bit cards in both Ethernet (6.4Mbps) and Fast Ethernet (9.7Mbps) throughput tests, and it had the highest overall modem throughput (30.6kbps).

A third product, the Xircom RealPort CardBus Ethernet 10/100 + Modem 56, deserves honourable mention for a groundbreaking design that integrates standard ports directly into the edge of a Type III card.

Compaq Microcom 550 56K Modem + 10/100 Ethernet PC Card

Type II 16-bit card, $556 Compaq Computer; 1300 368 369; www.compaq.com.au

The Compaq Microcom 550 56K Modem + 10/100 Ethernet PC Card produced lackluster scores in our tests and has few distinguishing features. This midpriced, 16-bit combo card is popular with new Compaq notebook customers seeking a one-stop shopping solution, but there is no compelling reason for others to choose it over the better-performing cards reviewed here.

Boasting two clearly marked dongles, this Compaq card uses a single Type II card slot and includes a user manual, as well as full documentation on CD. Installation took us only five minutes.

After setup, the Compaq card worked without a problem. It supported simultaneous network and modem activity, as well as network speed switching. Lights on the dongles show activity, and different-colour LEDs indicate network speed. The Compaq card delivered average performance on both our Fast Ethernet (7.7Mbps) and our Ethernet (6.0Mbps) tests. But with an average throughput of only 18.5kbps, it was the slowest of the products on the modem tests.

Aside from its mediocre performance, the Compaq Microcom 550 56K Modem + 10/100 Ethernet PC Card has no major

The Compaq Microcom combo card is a mid-price card with average performance.

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PERFORMANCE TESTS

Combination PC Cards

For this story, we tested 16-bit and CardBus PC Cards. Of the 16-bit cards, the 3Com Megahertz was the leader.

For CardBus cards, only 1.1Mbps separated the fastest from the slowest on our Fast Ethernet test. As the name implies, a combination card is really two devices crammed into a single card, in the sense that it has separate chips for network and modem connections. We tested both these functions. Our Network Tests, conducted at both 10Mbps Ethernet (10Base-T) and 100Mbps Fast Ethernet (100Base-TX) speeds, measure the relative throughput that each card sustains when used over a corporate LAN. The Modem Tests reflect both the performance of the modem (the average throughput measured in kbps) and the card's ability to cope with adverse phone-line conditions. Finally, to ensure compatibility, we tested each card under Microsoft Windows 95, 98, and NT 4.0.

NETWORK TESTS

Not surprisingly, our tests confirmed that the only area in which the CardBus interface offers a significant performance advantage is Fast Ethernet (100Mbps). The 16-bit bus, based on the ISA bus, has a maximum data transfer rate of 16MBps. CardBus, derived from PCI, can operate at speeds of up to 33MHz and has a 32-bit data path, resulting in a maximum data-transfer rate of 132MBps (yes, we mean mega*bytes* per second).

Whether you need a CardBus card depends on the way you typically utilise connections. For standard e-mail and Web browsing, for instance, the greater throughput capability of CardBus NICs will rarely come into play. But if you perform more network-throughput–intensive jobs, such as backing up your hard disk to a server, replicating your e-mail file, or copying large batches of files, you'll see a real difference.

Although the theoretical limit of Fast Ethernet is 100Mbps, our throughput results were in the 40s (for CardBus cards). There are a couple of reasons for this. First, we tested these cards as the vast majority of them will be used: as client NICs. In this role, the laptop PC driving the NIC can't request data fast enough to saturate the NIC's bandwidth potential. Second, the maximum throughput that any NIC can sustain is never as high as the theoretical maximum wire speed of the network because of the overhead exacted by the NIC driver and the operating system when processing the data.

MODEM TESTS

Our modem throughput test results were more clear-cut, withthe 3Com (30.6kbps) the obvious winner. The next-best performer, the Ositech, scored about 30 percent lower. Note that our tests introduced line impairments; you are likely to see higher throughput with 56k modems under better conditions. 3Com is the only vendor here that uses its own chip set; hence this card's showing came as no surprise. The 3Com V.90 modems exhibited the best performance in our recent roundup ("Your Last Modem?", December 15, 1998). The ability to negotiate a strong connection under adverse line conditions also comes into play. Under these circumstances, some modems have to retrain to a lower connection rate or resend packets, resulting in a lower average throughput. In our tests, we saw situations in which the IBM EtherJet, Intel PRO/100, and Xircom RealPort could not establish connections under particular line impairments, making the cards less attractive buys for the mobile user, who may encounter a variety of line conditions.

COMPATIBILITY TESTS

We tested each card with Windows 95 OSR2, Windows 98, and Windows NT Workstation. None of the cards had any trouble under Windows 95 or 98; the OS automatically detected the card, prompted us for the location of drivers, and properly installed the NIC and modem components. Windows NT Workstation, however, is quite another story. First, Windows NT doesn't support Plug and Play, so the OS detects the card while booting up, but not on insertion. Furthermore, the lack of Plug and Play means that sorting out IRQs and I/O addresses is a hassle. We had to shuffle resources for every card except the Ositech and the 3Com. Our advice: if you're running

flaws, but neither does it offer anything to separate it from the pack. The 3Com card is cheaper and represents a better choice if you're looking for a 16-bit solution.

IBM 10/100 EtherJet CardBus Adapter with 56K Modem

Type II CardBus card; Price to be announced IBM PC Company, 13 24 26; www.ibm.com.au

The IBM CardBus 10/100 EtherJet CardBus Adapter with 56K Modem is an able performer on Fast Ethernet networks, but it's less notable for its Ethernet and modem performance. The IBM card offers few frills, but it is expected to have a lower than average price when released (by the time you read this).

We took about five minutes to install the IBM card, which comes with a one-page quick-install card backed by a user manual. Like the other CardBus cards we tested, the IBM card configures the modem as COM5. And like Xircom, IBM includes with the card a Comsel.exe utility for reassigning COM ports—Intel offers one for download—but you'll be hard-pressed to find it, because neither the tool nor the topic is mentioned in the user manual.

Based on the Xircom chip set, the IBM 10/100 EtherJet CardBus Adapter with 56K Modem employs a two-dongle design with LEDs on the dongles for activity and network speed. We had no problems with simultaneous network and modem operation, but automatic network-speed switching didn't work as smoothly.

The IBM card delivered a strong performance on the Fast Ethernet tests (43.0Mbps). But at just 5.2Mbps, it lagged

The IBM 10/100 EtherJet CardBus Adapter with 56K Modem is a no-frills PC Card.

Windows NT, check with the PC Card vendor to make sure your laptop is on its compatibility list.

How We Tested

To test NIC performance, we used ZD NetBench 5.01's NIC throughput test. We performed Network Tests on an IBM ThinkPad 600E with a Pentium II/300 processor, 64MB of RAM, and CardBus slots, running Windows 98. Our test network included an Intel Express 10/100 Stackable Hub connected (using TCP/IP) to a Dell OptiPlex GX1 with a Pentium II/400 processor and 256MB of RAM, running Windows NT Server 4, SP 4. The ThinkPad used each card to make repeated 1K requests for a file on the server for 120 seconds. We used a 100MB test file to ensure that the client could not cache it, which would artificially inflate test results.

To test modem performance and robustness under impaired phone line conditions, we used ZD Labs' Modem Tests. We installed each product in a Gateway Solo 2500 with a Pentium II/300 processor and 64MB of RAM, running Windows 98. Each card was connected via Windows Dial-Up Networking to an Ascend Max 4048 remote-access server (RAS) with Rockwell digital modems. To simulate a phone network, we dialled over a Telephone Analysis System (TAS) 240 local-loop emulator and a TAS Series II central-site simulator. To measure the throughput under each line condition, we downloaded a compressed file to the Gateway notebook from an FTP server. The number we report for each modem is the average throughput (kbps) for the 56 real-world line conditions.

To ensure compatibility, we performed a series of tasks with each card using three different operating systems, and several popular makes and models of notebook PCs. Our Windows 95 OSR2 test laptop was a Toshiba Tecra 8000 with a Pentium II/300 processor and 64MB of RAM; for Windows 98 we used a Gateway 9100 XL; and for Windows NT Workstation, SP 3, we used the IBM ThinkPad. After installing each card, we created simultaneous connections with a network-based server and a RAS. We also tested for 10/100 autosensing capability by switching the speed of our 10/100 hub while the client continuously pinged another device on the network. — *Analysis written by Russ Iwanchuk*

NETWORK TESTS

Bold type denotes first place within each category. PC denotes Editors' Choice.

	Fast Ethernet Average Throughput (Mbps)	Ethernet Average Throughput (Mbps)
16-BIT PC CARDS		
Compaq Microcom	7.7	6.0
3Com Megahertz	9.7	6.4
CARDBUS CARDS (32-BIT)		
IBM EtherJet	43.0	5.2
Intel PRO/100	42.9	7.4
Ositech Jack of Spades	42.0	7.7
Xircom RealPort	43.1	6.4

BETTER ▶ BETTER ▶

● **The four CardBus cards,** from IBM, Intel, Ositech, and Xircom, all performed similarly on our 100Mbps Fast Ethernet tests: the Ositech's low score (42.0Mbps) was less than three percent below the leading score produced by the Xircom (43.1Mbps). We saw more variation in Ethernet performance of the CardBus cards. Here the Ositech (at 7.7Mbps) and Intel (at 7.4Mbps) performed best. Among the 16-bit cards, the 3Com stood out by achieving 9.7Mbps over Fast Ethernet. The next-best performer, the Compaq, came in 21 percent behind. The 3Com also got the highest Ethernet score in the 16-bit group, outperforming even the IBM CardBus-based NIC.

MODEM TESTS

Bold type denotes first place. PC denotes Editors' Choice.

	Average Throughput (Kbps)
Compaq Microcom	18.5
IBM EtherJet	19.7
Intel PRO/100	20.7
3Com Megahertz	21.3
Ositech Jack of Spades	30.6
Xircom RealPort	20.2

BETTER ▶

● **The 3Com pulled away** from the pack on modem tests with throughput scores of 30.6kbps, respectively. The next-best performer, the Ositech, trailed by about 30 percent. Three cards, the IBM, the Intel, and the Xircom, failed to establish connections under some adverse line conditions on our tests.

behind the other CardBus cards on Ethernet tests. In fact, two of the 16-bit cards (the Compaq and the 3Com cards) handily outperformed the IBM card on Ethernet tests. Furthermore, its modem performance (19.7kbps) was the second-slowest in our roundup.

Despite its strong Fast Ethernet performance, the IBM 10/100 EtherJet CardBus Adapter with 56K Modem lacks the all-around performance and the features found in the other products reviewed here.

Intel PRO/100 Mobile Adapter LAN + Modem56/32bit CardBus

Type II CardBus card $634 Intel, 02 9937 5800, www.intel.com.au

With the Intel PRO/100 Mobile Adapter LAN + Modem56/32bit CardBus, what you see is what you get. Like the other cards based on the Xircom modem chip set, the Intel card delivered only average modem performance, and it offers no extras. Nevertheless, the Intel card has few weaknesses, so it's a reasonable, low-priced solution.

During testing, we took about five minutes to install the Intel card. All the installation software and drivers are stored on a single CD, and once you begin, the installation requires almost no intervention. The printed documentation is sparse, but Intel augments it with an illustrated electronic manual. Aside from a few utilities, no additional software is included.

Once installed, the card worked correctly on both 10Mbps and 100Mbps LANs while supporting simultaneous modem and network connections. Like the other CardBus devices, the Intel modem selects COM5 by default. A downloadable utility lets you reset the COM port. Although it bears the same name (Comsel.exe) as the one bundled with the Xircom card, these utilities are not interchangeable.

Like the cards from Compaq and IBM, the Intel card offers two dongles. Also like these two cards, the Intel card yielded a relatively low modem throughput score (20.7Kbps). It fared much better on network tests, with solid throughput for both Fast Ethernet (42.9Mbps) and Ethernet (7.4Mbps) networks.

A thoroughly conventional CardBus

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PC MAGAZINE AUSTRALIA EDITORS' HOT LINKS

The Web is a great place to find products, services, and resources on portable computing and networking.

- **AT&T Telework Guide**
www.att.com/ehs/telecom.html
AT&T ought to know a little about telecommuting. More than 50 percent of the company's US-based managers (36,000 employees) telecommute. This site is designed to assist other companies in establishing telework policies for their own employees.

- **Port Inc.**
www.port.com
One of the leading destinations for globe-trotting computer users, Port is recognised for its array of carrying cases. But the company manufactures and sells a wide range of products for portable computing as well.

- **PC Magazine's Road Warrior Guide**
www.zdnet.com/pcmag/special/roadwarrior/_open.htm
The Road Warrior Guide provides checklists and tips for preparing to travel, as well as important contact information for various service providers and notebook manufacturers.

- **TeleAdapt**
www.teleadaptusa.com/
No matter where your travels take you, TeleAdapt has the equipment to keep you connected. TeleAdapt offers a comprehensive range of products including 40 telephone plug adapters for foreign phone systems.

The Intel card has a standard design, and it produced mixed performance results.

combo card, the Intel PRO/100 Mobile Adapter LAN + Modem56/32bit CardBus is a safe choice. But it won't attract any second glances from fellow road warriors.

Ositech Jack of Spades CardBus 10/100 + 56K Modem with DPI PC Card

Type II CardBus card; $774. Advanced Portable Technologies, 02 9433 8300; www.ositech.com

One of the most interesting cards in this roundup, the Ositech Jack of Spades CardBus 10/100 + 56K Modem with DPI PC Card has an ace in the hole: its support for both analogue and digital (PBX) and phone lines. Add to this the card's solid performance and bundled connection cables and you'll find that Ositech has dealt a winning hand.

The Ositech card uses a single Type II card slot. The separate, proprietary 6-foot modem and Category 5 network cables plug directly into the edge of the card. Although all the cards we tested offer digital-line protection, the Ositech's Digital Phone Interface (DPI) is the only one that allows you to make connections over digital lines via the phone's handset. A special dialog box pops up to assist in making the connection.

Our installation went smoothly. Aside from a quick-start guide, Ositech offers no printed documentation, but the CD-based manual is sufficient. Also included on the CD is CommLite, a communications package. Like the other CardBus modems, the Ositech installed by default as COM5. Unfortunately, Ositech does not provide a utility for reassigning the COM port. For those who both use non-TAPI-compliant applications—the only types that have difficulty with COM5—and must have a CardBus solution, we recommend one of the alternatives from IBM, Intel, or Xircom, which all include utilities.

The Ositech Jack of Spades is a good performer boasting some unique features.

Although the Ositech's Fast Ethernet score of 42.0Mbps was the lowest of the four CardBus solutions' results, it still achieved only three percent less throughput than the fastest card on this test (the Xircom card). More important, it produced the fastest throughput on Ethernet tests (7.7Mbps) and an average modem throughput score (21.3kbps).

Combining reliable performance with unique features such as support for digital phone lines and a dongle-free design, the Ositech is one of the best choices for all of your communications needs.

3Com Megahertz 10/100 LAN + 56K Modem PC Card

Type II 16-bit card; $469. Express Data, 02 9589 9100; www.3com.com.au

Of the 16-bit cards we tested, the 3Com Megahertz 10/100 LAN + 56K Modem PC Card delivered the best throughput. This card is less expensive than the Compaq and delivers more for the money, offering two RJ-11 phone jacks on the dongle, a standard 1.8m Category 5 network cable, and an elegantly illustrated manual. All of this makes the 3Com card our top non-CardBus choice.

The 3Com card occupies a single Type II PC Card slot and uses separate dongles for network and telephone connections. The modem supports data, fax and voice and includes Mobile SpeakerPhone and RapidComm Voice applications.

Installing the 3Com card took approximately five minutes. The card successfully completed all tasks including using the modem while connected to a network, and it accurately detected a switch from an Ethernet to a Fast Ethernet LAN.

In our tests, the 3Com card was the fastest of the 16-bit cards in both Ethernet (6.4Mbps) and Fast Ethernet (9.7Mbps) throughput tests. In addition, it had the highest overall average throughput in modem testing at 30.6kbps.

The 3Com Megahertz 10/100 LAN + 56K Modem PC Card's combination of features and performance give it the solid, reliable feel that you expect from a LAN/WAN solution.

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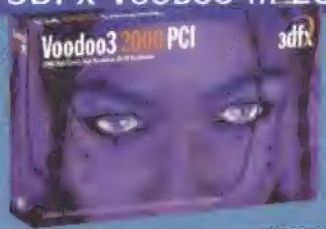

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SUMMARY OF FEATURES

Combination PC Cards

■ YES ■ NO	Compaq Microcom 550 56K Modem + 10/100 Ethernet PC Card	IBM 10/100 EtherJet CardBus Adapter with 56K Modem	Intel PRO/100 Mobile Adapter LAN + Modem56/32bit CardBus	Ositech Jack of Spades CardBus 10/100 + 56K Modem with DPI PC Card (PC MAGAZINE AUSTRALIA EDITOR'S CHOICE)	3Com Megahertz 10/100 LAN + 56K Modem PC Card (PC MAGAZINE AUSTRALIA EDITOR'S CHOICE)	Xircom RealPort CardBus Ethernet 10/100 + Modem 56
Street price	$556	TBA	$634	$774	$469	$659
Bus/Power requirement	16-bit/5.0V	CardBus/3.3V	CardBus/3.3V	CardBus/3.3V	16-bit/5.0V	CardBus/3.3V
Card slots occupied	One Type II	One Type II	One Type II	One Type II	One Type II	One Type III
Supports Windows 95 / 98 / NT	■■■	■■■	■■■	■■■	■■■	■■■
Size of ROM	4MB	4MB	4MB	2MB	4MB	4MB
Flash upgradable	■	■	■	■	■	■
Simultaneous LAN and modem use	■	■	■	■	■	■
NIC Features						
Controller ASIC	Xircom and Lucent Technologies	Xircom and Lucent Technologies	Xircom Dr. Pepper Rev 4	SMsC Epic-C	ASIC/TDK 78Q2120	Xircom and Lucent Technologies
10/100 auto-negotiation	■	■	■	■	■	■
Full-duplex support	■ (10 Mbps only)	■	■	■	■	■
Connector configuration	RJ-45 port on dongle	RJ-45 port on dongle	RJ-45 port on dongle	Direct connect proprietary cables	RJ-45 port on dongle	Internal ports
LEDs	Link integrity and transmission activity	Link integrity and transmission activity	Power, link integrity, and transmission activity	None	Link integrity and LAN speed	Carrier detect, transmit/receive, LAN activity, LAN speed, and link integrity
Modem Features						
Controller ASIC	Lucent Venus 1675	Lucent Venus 1675	Lucent Venus 1675	Rockwell L2600	Proprietary ASIC/TI 320C52	Lucent Venus 1675
Protocols supported	V.90, K56flex	V.90, K56flex	V.90, K56flex	V.90, K56flex	V.90, x2	V.90, K56flex
Connector configuration	RJ-11 port on dongle	RJ-11 port on dongle	RJ-11 port on dongle	Direct connect proprietary cables	Two RJ-11 ports on dongle (one pass-through)	Two internal RJ-11 ports (one pass-through)
Data/Fax/Voice	■■	■■	■■	■■	■■■	■■
LEDs	Carrier detect and transmit/receive	Carrier detect and transmit/receive	Power, link, and transmit/receive	None	None	Carrier detect and transmit/receive
Digital line protection/support	■	■	■	■■	■	■
Mobile telephone support	Digital/analogue cellular and GSM	Cellular, Ericsson 688/788, Motorola and Nokia 3110/8110	Cellular, AMPS, and GSM	AMPS, Motorola and Nokia; GSM, Ericsson and Nokia	Cellular, AT&T, Ericsson, GE, Motorola, Nokia, RadioShack, Technophone	Analogue cellular, DCS 1800, GSM 900, PCS 1900

Of the 16-bit cards we tested, the 3Com Megahertz 10/100 LAN + 56K Modem PC Card is the performance leader for both network and modem connections.

Xircom RealPort CardBus Ethernet 10/100 + Modem 56

Type III CardBus card, $659. Xircom; 02 8923 7000; www.xircom.com

A Type III card (occupying two slots), the Xircom RealPort CardBus Ethernet 10/100 + Modem 56 is based almost entirely on one key feature: it lets you connect without proprietary dongles or cables. Whether this is an advantage or not, however, depends on your mobile computing needs.

The 32-bit Xircom PC Card offers two RJ-11 phone line ports, an RJ-45 10/100+ network port, a cellular or GSM telephone adaptor port, and four small LED connection-speed and activity lights. Since you can plug standard network and modem cables directly into the card, this design lessens the number of pieces you need to carry. And, in case you forget or lose your cables, you can easily find a replacement. But the dual-slot requirement means that on most notebook computers, you can't insert other PC Cards while connected.

Like other CardBus modems, the Xircom selects COM5 by default. Fortunately, Xircom includes a utility that lets you change the port after installation.

The Xircom card supports simultaneous network and modem connections as well as network speed switching. Throughput performance was similar to the other CardBus cards, with a strong score (43.1Mbps) on Fast Ethernet, but a slightly below-average score (6.4Mbps) on Ethernet tests. Its 20.2kbps modem throughput was less impressive.

The Xircom gets high marks for its innovative design. If you can live without the extra slot, it may be an attractive option. ■

The Xircom RealPort frees you from having to carry dongles or proprietary cables.

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Anna Raciti

4Warned is 4Armed

There's something happening out in PC-retail land. It involves a big plan—a plan to bring PC retailers together, a plan to improve service and support, a plan to increase consumer confidence and, of course, to rake in a whole lot of money. The venture involves the formation of a retail chain selling computer hardware and software. One hundred stores will begin trading under the 4Ware banner from the first of May, with around 250 more stores expected to follow suit in ensuing months.

The 4Ware project was dreamed up over four years ago but it wasn't until this year that the brains behind the idea believed the time was right for launch. John Osgood, National Manager for 4Ware points to the strength of larger PC vendors such as Dell, Gateway and even Harvey Norman when explaining why small PC retailers need to band together under a common name and philosophy. For Osgood, 4Ware gives small vendors the opportunity to compete against big players: "At the moment, an independent store is very vulnerable," says Osgood, "By joining the group it becomes stronger."

To begin with, the initial 100 stores that have decided to take part will keep their existing company names and sell 4Ware branded products in addition to their existing stock. As time goes on though, 4Ware will become more like a single, large retail chain selling 4Ware hardware only. 4Ware head office will provide the brand's marketing and advertising as well as controlling product design and pricing. The concept, according to Osgood, should see 4Ware develop into a business similar to Retravision or McDonalds.

A number of problems exist in this industry that warrant urgent attention. The greatest problem faced by small PC retailers is a lack of customer confidence. For years PC retailers have been labelled as unreliable, in fact I'd be surprised if they rank much better than used car dealers and tabloid journalists in most people's minds. Consumers have been loath to trust vendors that they believe could go out of business and leave them stranded without warranty or technical support. We've heard the stories of customers left stranded with dud machines. This happens more often than it should. 4Ware aims to grab consumer confidence by giving small retailers some of the power and strength that comes from being a large vendor.

A project such as 4Ware also arms vendors with the ammunition (via a strong brand name) to compete with the likes of a Dell or Gateway. National businesses and government sectors are, after-all, not going to buy from their local suburban PC shop. Larger businesses, as well as everyday consumers, demand the type of service and support that only larger vendors can offer. With 4Ware they might get it. All products will be built to specific 4Ware specifications and all will be supported by the entire 4Ware chain. (regardless of the store from which they were bought). Tech support will also be handled through an Australia-wide 1300 number operating from 8am to 10pm.

As for the quality of 4Ware product—stay tuned! A 4Ware PC arrived at our Test Lab too late to be part of this month's PIII 500MHz test, but you should find a First Looks review of the product in next month's *PC Magazine Australia*. What we've seen so far looks good—the PC looks well-built and speedy. 4Ware branded PCs are available in six models. The Spitfire (entry-level machine), the Mustang (for small office and home office users), the Hellcat (corporate machine), Marauder (games machine), Typhoon (designed for Internet use), and the Lightning (for power users). All PCs will include 3-year parts and labour warranty and full tech support. The company expects to constantly increase the number of 4Ware products offered for sale in stores stock a full range of 4Ware hardware and peripherals.

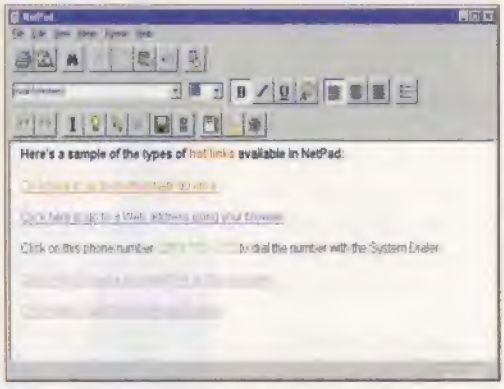
"At the moment, an independent store is very vulnerable . . . by joining a group it becomes stronger."

NETSHOPPER

NetPad 3.1

Flying Objects; Download Price: US$19; Size: 1812KB; Free demo available; www.flyingobjects.com

Integrating and linking diverse bits of information can be a daunting task even in the most sophisticated of information managers. But linking information from different services is NetPad 3.1's main function. The software is designed for Internet users who want to store their information the way they need it, by creating links between notes, Web-pages, files, and more.



NetPad lets you store information from Web sites (with links intact) as well as letting you create your own notes and documents. The latest version adds an online manual; an encryption feature to protect your notes; and search capabilities (both exact searches and and "fuzzy" searches for when you are unsure of exact spelling). *—Anna Raciti*

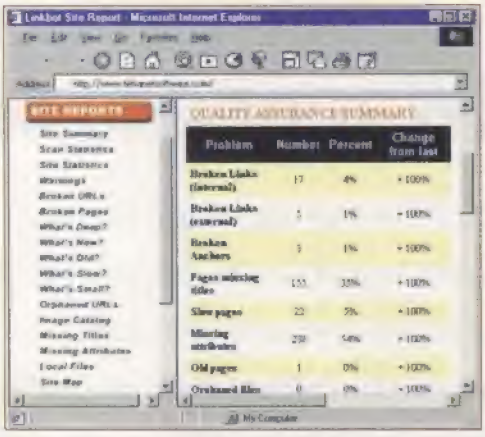
Linkbot Pro 4.0

Tetranet Software; Download Price: US$295; Size: 4800KB; Free demo available; www.tetranetsoftware.com

How many times have you gone to a Website and found broken links and graphics? It's pretty annoying isn't it? Well, what if visitors to your Web site come across broken links or other irritating mistakes? They may not come back for a second look. This is obviously something you want to avoid, and Linkbot Pro 4.0 can help you do just that.

While Linkbot is excellent at verifying links its functionality goes well beyond that. It automatically scans your Website for more than fifty potential problems including JavaScrip errors and generates HTML reports detailing the errors that need to be fixed.

Linkbot Pro 4.0 can quickly scan enormous numbers of pages as well as parse through JavaScript and HTML 4.0 syntax. You can also automate processes with Linkbot Pro. Linkbot can be programmed to turn itself on, check a site at regular intervals and produce a graphical report for a quick visual summation of problems. *—James Stanford*



Fortress Personal Lie Detector

Digital Robotics; Download Price: US$29.95; Size: 1400KB; Free demo available; www.digitalrobotics.com

Armed with Digital Robotics' Fortress Personal Lie Detector and a microphone, you can now analyse friends' and collegues' voices to detect lies. When a person lies, their voice gives away the subliminal stress that is generated. Fortress tests voices using complex algorithms to detect these minute changes in stress levels and give a fairly accurate account of whether the person is lying.

Users have the ability to analyse from recorded audio, TV broadcasts, telephones and more—but the program comes with explicit instructions that the program be used only to analyse subjects that have consented to the process. *—Anna Raciti*

Online Stores

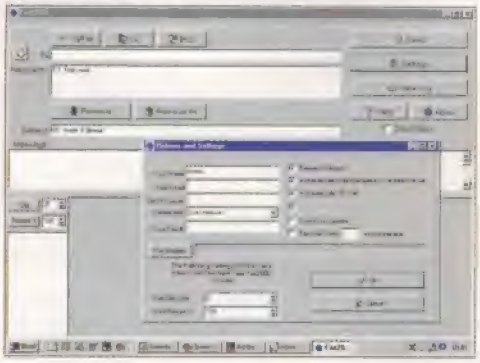
Flourish Flower Merchants

www.flourish.com.au; Description: Flowers, hampers and gifts for sale.

Are you too busy to go shopping for gifts? The Flourish Website was designed to make it easier for busy people and businesses to order flowers, hampers and other gift items online. The site features a virtual store "walk-through" using Quick Time 3 software. Browse the virtual shop shelves for items such as flowers, biscuits, pillows and other gifts or choose from Flourish's pre-packed gift selections such as the "Beauty Queen" pack comprising bath salts, soaps, gels and beauty creams. *—Anna Raciti*

Fax 2000

CCR; Download Price: US$39.95; Size: 2176KB;Free demo available; www.ccr.net



Fax2000 combines a print driver with an e-mail client to enable you to send images as e-mail attachments or faxes. You can access the driver from any program on your computer that offers print support.

Select the Fax2000 print driver to print the open graphic or document to a GIF graphic file and open the Fax2000 e-mail client. Address the message, add a subject and any text you'd like to include, and you're all set.

Features include BCC support, mailing list support, and document resizing. You can set up the Fax2000 Inbox to automatically retrieve your e-mail messages and attachments. Schedule the days, times, and frequency and tell it whether to grab all messages or only those that contain Fax2000 file attachments.

Despite its name, Fax2000 isn't a fax program—you can't use it to receive faxes. Online help is included. —*Ben Z. Gottesman*

A-1 Image Screen Saver

Acez; Download Price: US$14.95; www.acez.com

What better way to customise your PC than to run your own screen saver? Boring defult screen savers are a thing of the past thanks to software such as Acez' A-1 Image Screen Saver. The program lets you display all kinds of images on your PCs—the program supports GIF, JPG, BMP, and other popular image types.

Best of all, you can display an unlimited selection of your favourite photos through the program's slide show option. A-1 features nine different image transitions such as fade and scroll; supports password protection; can show your slides in random order; allows you to resize your images to correct screen size; and can display your images on a semi-transparent background. You can set your own captions or messages running over your screen saver images, or check out the program's new on-screen Year 2000 countdown clock.—*Anna Raciti*

Spread 3.0

FarPoint Technologies; Download Price: US$249; Size: 7500KB; Free demo available; www.componentsource.com

Looking for an Excel alternative? FarPoint's Spread 3 can create powerful database front-ends, manage the display and entry of two billion rows and two billion columns using the enhanced Virtual Mode, print reports, perform calculations, import/export files and sort data. The new version also imports and exports from Microsoft Excel 97 format, the two formats are fully compatible. Those interested in publishing their spreadsheets to the Internet now have the ability to do so easily because the program exports files as HTML files.—*Anna Raciti*

DropChute Pro

Hilgraeve; Download Price: US$99.95; Free demo available: www.hilgraeve.com

Wouldn't it be nice to be able to transfer a file to a co-worker or client over the Internet, an intranet or from modem to modem, and chat at the same time? You can with DropChute Pro, a software althernative to e-mail, FTP, fax machines and the post.

Online Stores

Drive.com.au

www.drive.com.au; Description: New and second-hand cars for sale, articles and reviews

Combining the resources of *The Sydney Morning Herald*, *The Sun Herald* and *The Age* newspapers, this new Fairfax site offers visitors all kinds of information about buying and sellings cars. The site gives guides to current market values, pros and cons for particular vehicles and finance and leasing rates. You can look up reviews of a car you are interested in and even compare cars on your short-list side-by-side.

If you're not in the market for a car, but are interested in the motor market, you can still use the site to catch up on the latest motoring news; check the Garage section for a database of other vehicles and items for sale such as motorbikes, trucks, caravans, spare-parts, and number plates; or take advantage of the Smart Drives section that gives you tools and tips to keep your car running in peak condition (including a guide on how to better communicate with your mechanic). —*Anna Raciti*

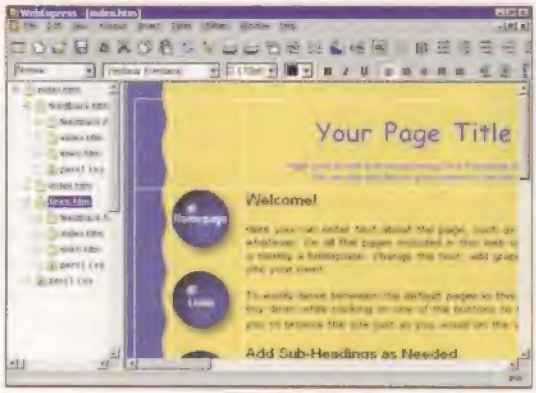
DropChute™ Pro

With DropChute Pro you can easily transfer files over a LAN or the Internet. This 32-bit Windows application uses TCP/IP to locate and connect to other machines. You can transfer files while online doing other tasks or even while chatting to a friend.

Transfers are encrypted to provide security and compressed to speed up the copy. Even if the destination isn't connected to the Internet, DropChute can still work: the Internet Rendezvous feature will dial directly to the destination computer then tell it to hang up and connect to the Internet through the configured ISP. Full online help is included. —*Harvey Jones*

WebExpress

MicroVision Development
Price: US$69.95
Free demo available:
www.mvd.com

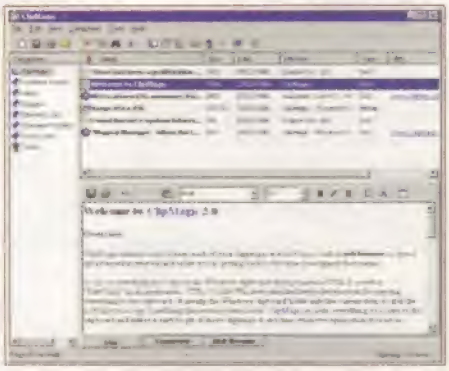


If our own John C. Dvorak says it's the best Web-page layout editor he's ever seen, you know this program's got something going for it! Web Express is designed for novice Web designers just starting out, or for more experienced users seeking something more than a basic WYSIWYG editor.

Use the program's Quick wizards and the online Web Tutor to help you create your site. They will help you with more complex issues such as frames, plug-ins and forms. Web-site themes are also available to help you set a uniform design.

An improved Web Site Manager helps you keep track of the links and images within your new site. Handy tools in the Web Site Manager allow you to rename a link universally throughout your site when you rename the associated page; view the entire hierarchy of your site; and choose views that help you track local links, Web links, images, style sheets, and form-handling files.

Editing your Web-page text with WebExpress is as simple as editing a word processing document. The control strips (the equivalent of toolbars) contain buttons that allow you to alter the alignment, formatting, and font of your text. The new multimedia plug-in wizard makes it simple to add sounds, video clips, and other plug-in files by following a few steps.



When you're done editing your site, you simply click on the Publish button to upload it to your Web server. —*Andrea Mercado*

ClipMagic

MJT Net; Download Price: $55; Free demo available; www.aquatee.com

ClipMagic is a Clipboard enhancement utility that runs from the system tray. It can intercept and add all text and images copied to the Clipboard to a clip list. Add and manage as many clip lists as you like. You can easily toggle Clipboard capture on and off and establish criteria for automatically saving clips to the proper list. The program also allows you to copy, delete, and edit text clips from a dialog box you access from the system tray.

You can assign hotkeys to individual clips, add comments, perform text searches, change the display font, and print selected clips. When the program next runs, it automatically saves and reloads the contents of the list. Other features include capture filters, an built-in Web browser, and automatic text pasting. ClipMagic is versatile enough to use as a clip list manager or a Clipboard multiplier, and it works exceedingly well as either or both. —*Karen Banman*

Online Stores

Auction Shopping Australia

www.auctionshop.com.au;
Description: Small electrical and computer hardware and software for auction.

Next time you're in the market for software, hardware or even new kitchen appliances, consider buying from an online action site. With Auction Shopping Australia you set the price you want to pay for the product you're interested in, and if you are the top bidder at the end of the auction period, the product is yours.

The site features new, brand-name products and starting prices are usually about 20 percent off the normal recommended retail price.

To bid, users will need to register, once that is complete, bidding can be done at any time at no cost. —*Anna Raciti*

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L/Jet 2100	$1325
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Pen III 450	$1295

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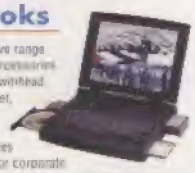

Toshiba 2520 CDT	Toshiba 4000 CDT	Compaq 1592 DT	Compaq 1598 DT	H.P. 4100 CT	H.P. 4100 CTX
AMD K6-II 300	Pentium II 233	Pen 233 MMX	Pen 266 MMX	Pentium II 233	Pentium II 266
64 MB, 4.0 GB	32 MB, 4.0 GB	32 MB, 3.2 GB	32 MB, 4.0 GB	96 MB, 4.0 GB	96 MB, 6.4 GB
12.1" Active	12.1" Active	12.1" Active	13.3" Active	13.3" Active	14.1" Active
24 x CD. FDD	24 x CD. FDD	20 x CD. FDD	20 x CD. FDD	24 x CD. FDD	24 x CD. FDD
Windows 98	Windows 98	Windows 95	Windows 95	Windows 98	Windows 98
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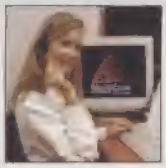

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- **TaskMaster 98** Manage project time allocation
- **WebFormFill** Fill in Web forms automatically
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- **Absolute Headline Fonts** New life for your fonts folder
- **Absolute Script Fonts** Add five script faces
- **Disable Plus** Protect your desktop

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If you are an individual or business that charges by the hour, then ContractPro is the business system for you! ContractPro lets you measure, monitor and manange your business, putting you in charge of your profits!

Top Tips

Looking for a few pointers on getting your new Windows 98 up and running? These forty useful hints and tips will set you on your way.

Games

This month we bring you demos of Street Wars, Slave Zero, Sports Car GT, Tanktics, and Daikatana. We've also included the stunning trailer for Star Wars: The Phantom Menace—Episode One, Trailer 2.

Browsers

Choose from Netscape Communicator Pro, Microsoft Internet Explorer 4.01 or Opera 3.5. If there's a browser you'd like to see, let us know.

Utilities

We include the best utilities such as Go Ahead Got It!, IEClean Cookie Manager, Display Doctor, PKZip, BulletProof FTP, ICQ, eSafe Protect, Nuts & Bolts and CleanSweep Uninstaller.

Plus Net tools, virtual tours and more.

"I have a Web browser"

If your "Autoload" feature is enabled, the CD will launch by itself. If your CD does not launch automatically, start your browser, then from the file menu select "Open" ("Open file in browser" for Netscape Navigator), "Browse" to your CD drive and access index.htm.

"I don't have a Web browser"

Step 1: Explore the PC Mag CD using Windows Explorer.

Step 2: Open the folder "Brwrs", then select either the "Netscape" or "Microsoft" folder according to which browser you would like to install.

Step 3i: For Netscape Communicator suite, transfer 'Cp32e405.exe' to your hard drive and activate it. For Netscape Navigator standalone, transfer 'N32e405.exe' and activate it .

Step 3ii: For Internet Explorer 4.0, activate 'iesetup.exe' in the CD folder.

Step 4: Follow the onscreen instructions to install the software.

Step 5: To launch the CD, explore the CD-ROM again, and click on 'index.htm'. Your Web browser will open this for you.

Every month *PC Magazine CD* comes packed with programs, tools, demos and more. To access the ZDNet Software Library visit www.zdnet.com.au/swlib/.

Buyer's Guide

On the following pages, you'll find a comprehensive roundup of recent comparison tests we have run in *PC Magazine Australia*. In addition to serving as an index to these tests, this regular section provides information designed to help buyers make informed decisions on a wide range of products.

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PENTIUM II NOTEBOOKS

	Price	Vendor/Distributor	The Specs	Winstone 98	Batt Life (hrs)	Reviewed
Acer TravelMate 7300TE	$7999	Acer Computer, Ph: 02 9870 1999	PII 266MHz, 64MB SDRAM, 3.6GB HD, 13.3in TFT screen	19.5	2:29	Jul-98
Acer Extensa 712E	$6999	Acer Computer, Ph: 02 9870 1999	PII 300MHz, 64MB RAM, 6.5GB HD, 13.3in TFT screen	13.0 (99)	2:12	Jan-99
Compaq Armada 1700	$8995	Compaq, Ph: 02 9911 1999	PII 300MHz, 32MB RAM, 5GB HD, 14.1in TFT screen	9.3 (99)	2:06	Jan-99
M Compaq Armada 7800	$10,496	Compaq, Ph: 02 9911 1999	PII 266MHz, 64MB EDO RAM, 4.7GB HD, 13.3in TFT screen	20.6	1:26	Jul-98
Dell Inspiron 3200 D266XT	$4798	Dell, Ph: 1800 808 312	PII 266MHz, 32MB SDRAM, 3.8GB HD, 13.3in TFT screen	18.5	1:51	Jul-98
E Dell Inspiron 3500 D300GT	$5454	Dell, Ph: 1800 808 312	PII 300MHz, 64MB RAM, 6.5GB HD, 14.1in TFT screen	14.6 (99)	1:41	Jan-99
Digital HiNote VP765	$5650	Digital, Ph: 02 9561 5252	PII 266MHz, 32MB SDRAM, 3.8GB HD, DVD, 13.3in TFTn	18.4	1:53	Jul-98
FIC DesigNote 5600	$2995	First International Computers, Ph: 02 9870 8077	PII 300MHz, 64MB RAM, 6.5GB HD, 13.3in TFT screen	13.5 (99)	1:26	Jan-99
Firstlite 1100M 26T3	$4490	Formosa International Group, Ph: 07 3846 7979	PII 266MHz, 64MB RAM, 4.3GB HD, 13.3in TFT screen	13.3 (99)	2:05	Jan-99
Firstlite 1100M 30T4	$5650	Formosa International Group, Ph: 07 3846 7979	PII 300MHz, 128MB RAM, 4.3GB HD, 14.1in TFT screen	14.5 (99)	2:01	Jan-99
E Gateway Solo 9100XL	$8499	Gateway, Ph: 1800 500 729	PII 266MHz, 64MB SDRAM, 7.6GB HD, 14.1in TFT screen	19.9	2:14	Jul-98
oRiS Madrigal	$5899	Elcomp, Ph: 03 9429 8033	PII 266MHz, 64MB SDRAM, 2GB HD, 12.1in TFT screen	17.0	1:58	Jul-98
Prodigy 668T14	$5465	Integral Computers, Ph: 03 9580 4088	PII 300MHz, 64MB RAM, 4.3GB HD, 14.1in TFT screen	13.2 (99)	1:42	Jan-99
M Tecra 780DVD	$11,459	Toshiba, Ph: 1800 021 100	PII 266MHz, 64MB EDO RAM, 4.77GB HD, DVD, 13.3in TFT screen	20.1		Jul-98
TPG 1500L	$4999	Total Peripherals Group, Ph: 02 9850 0800	PII 300MHz, 64MB SDRAM, 4.2GB HD, 12.1in TFT screen	N/A	1:51	Jan-99
Twinhead SlimNote EX2 266TG	$7499	Westan, Ph: 03 9563 6775	PII 266MHz, 64MB RAM, 3.8GB HD, DVD, 13.3in TFT screen	19.2	2:05	Jul-98
Twinhead SlimNote VX	$5399	Westan, Ph: 03 9563 6775	PII 300MHz, 64MB RAM, 4.3GB HD, 13.3in TFT screen	11.7 (99)	1:52	Jan-99

233MHZ NOTEBOOKS

	Price	Vendor/Distributor	The Specs	WinBench 98	Batt Life (hrs)	Reviewed
Acer TravelMate 7130TE	$7999	Acer Computer, Ph: 02 9870 1999	P233MMX, 3GB HD, 32MB SDRAM, 16X CD, 12.1in TFT	67.7	3:59	Jan-98
Compaq Armada 7770	$9995	Compaq, Ph: 02 9911 1999	P233MMX, 2.87GB HD, 64MB SDRAM, 20X CD, 12.1in TFT	N/A	2:00	Jan-98
Dell Inspiron 3000	$5999	Dell, Ph: 1800 808 312	P233MMX, 2GB HD, 64MB SDRAM, 20X CD, 13.3in TFT	62.7	2:07	Jan-98
Gateway Solo 9100	$7999	Gateway, Ph: 1800 500 729	P233MMX, 4.78GB HD, 64MB SDRAM, 16X CD, 13.3in TFT	76.1	3:25	Jan-98
HP OmniBook 3000CTX	$8738	Hewlett-Packard, Ph: 13 13 47	P233MMX, 3.8GB HD, 80MB RAM, 13.3in TFT	68.8	2:18	Jan-98
E IBM ThinkPad 770	$12,280	IBM, Ph: 13 24 26	P233MMX, 4.86GB HD, 64MB SDRAM, 14.1in TFT	96.6	2:22	Jan-98
Leo-DESIGNote 6000	$6999	First International Computers, Ph: 02 9870 8077	P233MMX, 3.16GB HD, 32MB EDO RAM, 16X CD, 13.3in TFT	62.1	2:11	Jan-98
M Micron TransPort Xkit	$8283	Dytec, Ph: 1800 062 206	P233MMX, 4.77GB HD, 64MB RAM, 20X CD, 13.3in TFT	N/A	3:31	Jan-98
Omega Dragon	$4590	Omega Wholesale, Ph: 08 9249 9288	P233MMX, 2GB HD, 32MB SDRAM, 16X CD, 12.1in TFT	55.5	1:26	Jan-98
Toshiba Tecra 750 CDT	$10,417	Toshiba, Ph: 1800 021 100	P233MMX, 4.77GB HD, 32MB RAM, 16X CD, 13.3in TFT	79.0	2:21	Jan-98
Twinhead SlimNote EX	$8999	Westan, Ph: 03 9563 6775	P233MMX, 3.8GB HD, 64MB RAM, 16X CD, 13.3in TFT	90.7	2:20	Jan-98

ULTIMATE GAMES PCS

	Price	Vendor/Distributor	The Specs	Winstone 98	QuakeBench II (fps)	Reviewed
E Adelong Advantage Gamer MP400	$3995	Adelong Computers, Ph: 1800 626 345	PII 400MHz, 64MB RAM, 5.12GB HD, 32x CD-ROM, 17in mon	27.4	N/A	Dec-98
Alfa Deltacom 2400 TNT	$5395	Alfa Computers, Ph: 02 9317 3344	PII 450MHz, 128MB SDRAM, 9.1GB HD, DVD, 19in monitor	30.8	38.0	Dec-98
E Beyond Ultimate Games Computer	$5780	BCN Computers, Ph: 02 9417 3688	PII 450MHz, 128MB SDRAM, 5.1GB HD, 32x CD-ROM, 17in monitor	34.2	42.8	Dec-98
Canda Ultimasi Games 450	$4970	Canda International, Ph: 03 9574 9760	PII 450MHz, 128MB SDRAM, 10.25GB HD, DVD, 17in mon	27.0	75.5	Dec-98
Compaq Presario 5170	$4099	Compaq, Ph: 1300 368 369	PII 350MHz, 64MB SDRAM, 6.4GB HD, DVD, 27in monitor	22.5	9.5	Dec-98
Compu Centre Evolution	$7495	Compu Centre, Ph: 03 9818 5022	PII 450MHz, 128MB SDRAM, 9GB HD, DVD, 17in monitor	32.7	84.7	Dec-98
Dual Ultimate Games 300	$3050	Dual Technologies, Ph: 03 9887 7888	Celeron 300MHz, 64MB SDRAM, 6.4GB HD, 32x CD-ROM, 17in	17.1	7.7	Dec-98
G&A Spirit 450BX	$5100	G&A Computer Technology, Ph: 02 9740 4258	PII 450MHz, 128MB SDRAM, 7.5GB HD, DVD, 17in monitor	30.6	37.7	Dec-98
M Gateway G6-450	$8034	Gateway, Ph: 1800 500 918	PII 450MHz, 128MB SDRAM, 14.4GB HD, DVD, 19in monitor	26.4	20.1	Dec-98
Hallmark Viewmaster	$6095	Hallmark Computer, Ph: 03 9562 6789	PII 450MHz, 128MB SDRAM, 6.8GB HD, 32x CD-ROM, 19in mon	28.6	51.1	Dec-98
Integral Prodigy PII 450	$4995	Integral Computers, Ph: 03 9580 4088	PII 450MHz, 64MB SDRAM, 10.1GB HD, 32X CD-ROM, 17in mon	29.9	37.9	Dec-98
Just Bytes Game Gear	$4299	Just Bytes, Ph: 02 9749 7888	PII 350MHz, 128MB SDRAM, 5.1GB HD, 36x CD-ROM, 17in mon	25.8	54.5	Dec-98
MBI PowerGamer K6	$3799	MBI, Ph: 02 9645 6444	AMD K6-2 350MHz, 128MB SDRAM, 10.1GB HD, 32x CD-ROM, 17in monitor	23.3	N/A	Dec-98
MBI PowerGamer PII	$5999	MBI, Ph: 02 9645 6444	PII 450MHz, 128MB SDRAM, 10.1GB HD, DVD, 17in monitor	30.6	75.7	Dec-98

MicroArts Power Pro 450	$7295	MicroArts Australia, Ph: 03 9696 5955	PII 450MHz, 128MB SDRAM, 9.1GB HD, 40x CD-ROM, 17in mon.	32.2	39.8	Dec-98
Optima Vizon	$4995	Optima, Ph: 02 9475 2777	PII 450MHz, 128MB SDRAM, 9.1GB HD, DVD, 17in monitor	29.0	35.7	Dec-98
PC Direct Discovery 580-D	$2899	PC Direct, Ph: 02 9698 8855	AMD K6-2 350MHz, 64MB SDRAM, 6.4GB HD, 32x CD-ROM, 17in mon.	21.4	N/A	Dec-98
M Pioneer 98 PII 450	$4899	Pioneer Computers Australia, Ph: 02 9690 2888	PII 450MHz, 64MB SDRAM, 10.1GB HD, 32x CD-ROM, 17in mon.	29.8	39.3	Dec-98
TPG Ultra PII Office	$5495	Total Peripherals Group, Ph: 02 9850 0839	PII 450MHz, 128MB SDRAM, 9.1GB HD, 36x CD-ROM, 19in mon.	31.0	38.3	Dec-98
Ultimate Games System	$5299	Ultimate Computing Technology, Ph: 03 9584 2896	PII 450MHz, 64MB SDRAM, 9.1GB HD, 32x CD-ROM, 17in mon.	27.8	50.7	Dec-98

333MHz Multimedia PCs

	Price	Vendor/Distributor	The Specs	Winstone 98	QuakeBench II (fps)	Reviewed
Busi-Soft PII Performance System	$5599	Busi-Soft Computers, Ph: 03 9890 8900	PII 333MHz, 64MB SDRAM, 6GB HD, DVD, 17in monitor	24.2	56.4	Jun-98
Canda CH598	$4999	Canda International, Ph: 03 9574 9760	PII 333MHz, 64MB SDRAM, 6GB HD, DVD, 17in monitor	22.9	34.6	Jun-98
Evolution Multimedia	$5795	Compu Centre, Ph: 03 9642 5999	PII 333MHz, 128MB SDRAM, 2 x 4.1GB HD, DVD, 17in monitor	23.3	70.5	Jun-98
Dell Dimension XPS D333	$3749	Dell, Ph: 1800 808 312	PII 333MHz, 64MB SDRAM, 7.8GB HD, DVD, 15in monitor	21.4	34.3	Jun-98
Deltacom LX PTII	$3699	Alfa Computers, Ph: 02 9317 3344	PII 333MHz, 128MB SDRAM, 4GB HD, 32X CD-ROM, 17in monitor	21.7	34.1	Jun-98
E G&A Spirit 333	$4695	G&A Computer, Ph: 02 9740 4256	PII 333MHz, 64MB SDRAM, 6GB HD, DVD, 17in monitor	23.2	74.1	Jun-98
Gateway G6 333	$4435	Gateway, Ph: 1800 500 729	PII 333MHz, 64MB SDRAM, 7.8GB HD, DVD, 17in monitor	23.1	36.1	Jun-98
HP Pavilion 8220	$5999	Hewlett-Packard, Ph: 13 13 47	PII 333MHz, 64MB SDRAM, 7.5GB HD, DVD, 17in monitor	20.2	37.6	Jun-98
Dreamworks 333	$4895	Landmark Computers, Ph: 02 9985 9988	PII 333MHz, 64MB SDRAM, 7.9GB HD, DVD, 17in monitor	22.6	70.5	Jun-98
SmartPartner II	$5999	MBI, Ph: 02 9645 6444	PII 333MHz, 128MB SDRAM, 6GB HD, DVD, 17in monitor	20.6	71.8	Jun-98
M PowerPro 98 ATX 333	$4196	Microarts, Ph: 03 9696 5955	PII 333MHz, 64MB SDRAM, 6GB HD, 32X CD-ROM, 17in mon.	23.3	56.7	Jun-98
Navada PowerMax 333	$5199	Navada Computers, Ph: 08 9446 4099	PII 333MHz, 128MB SDRAM, 4GB HD, DVD, 17in monitor	22.1	68.5	Jun-98
Olympic Javelin 9000	$8995	Z-Tek Computers, Ph: 03 9552 2888	PII 333MHz, 128MB SDRAM, 8.5GB HD, DVD, 19in monitor	25.0	57.0	Jun-98

400MHz Pentium II PCs

	Price	Vendor/Distributor	The Specs	Winstone 98	WinBench 98 Bus.	Reviewed
Busi-Soft PII Performance System	$4985	Busi-Soft Computers, Ph: 03 9890 8900	PII 400MHz, 128MB SDRAM, 8.5GB HD, 32X CD-ROM, 17in monitor	39.1	116	Aug-98
Compucon Graphics Workstation	$4675	Compucon, Ph: 02 9417 7166	PII 400MHz, 128MB SDRAM, 6GB HD, 32x CD-ROM, 17in monitor	35.6	74	Aug-98
Dell Dimension XPS R400	$4709	Dell, Ph: 1800 808 312	PII 400MHz, 64MB SDRAM, 7.9GB HD, DVD, 17in monitor	30.5	83	Aug-98
M Gateway G6 400	$4966	Gateway, Ph: 1800 500 729	PII 400MHz, 64MB SDRAM, 9.4GB HD, 32X CD-ROM, 17in mon.	39.6	149	Aug-98
Diamond 400	$4500	Landmark Computers, Ph: 02 9985 9988	PII 400MHz, 128MB SDRAM, 7.9GB HD, 32X CD-ROM, 17in monitor	38.6	165	Aug-98
Navada PowerMax 400	$3875	Navada Computers, Ph: 08 9446 4099	PII 400MHz, 128MB SDRAM, 4GB HD, 36X CD-ROM, 17in mon.	38.5	178	Aug-98
E Pioneer 98 PII 400	$6420	Pioneer Computers, Ph: 02 9690 2888	PII 400MHz, 128MB SDRAM, 4.2GB HD, 32X CD-ROM, 17in mon.	41.7	169	Aug-98
Nautilus 400	$4599	Um Tron, Ph: 03 9819 6677	PII 400MHz, 128MB SDRAM, 6GB HD, 32X CD-ROM, 17in mon.	37.1	155	Aug-98
ViewMaster PII/400	$5895	Hallmark Computers, Ph: 03 9562 6789	PII 400MHz, 128MB SDRAM, 6GB HD, DVD, 19in monitor	33.0	38	Aug-98

Non-Intel PCs

	Price	Vendor/Distributor	The Specs	Winstone 98	WinBench 98 CPU	Reviewed
Aopen Performer 333	$1899	Bootstrap Computers, Ph: 02 9692 9988	AMD K6-2 333MHz, 64MB RAM, 4.3GB HD, 40X CD-ROM, 17in	10.7	627	Mar-99
APD AMD K6-2 350	$2499	APD International, Ph: 02 9737 8277	AMD K6-2 350MHz, 64MB RAM, 6.4GB HD, 36X CD-ROM, 17in	13.9	802	Mar-99
Digistore DG-300SA	$1895	Digistore Australia, Ph: 02 9897 5855	AMD K6-2 300MHz, 64MB RAM, 6.4GB HD, 36X CD-ROM, 17in	15.7	742	Mar-99
Elite AMD K6-2 350	$1865	Elite Industries, Ph: 02 9898 0222	AMD K6-2 350MHz, 64MB RAM, 4.3GB HD, 36X CD-ROM, 17in	12.9	738	Mar-99
E Hyperion 6400 Series	$3199	Compucon, Ph: 02 9417 7898	AMD K6-2 400MHz, 128MB RAM, 10GB HD, 32X CD-ROM, 17in	19.7	830	Mar-99
E Leo Persica 800 K6-2 400	$2495	Zylax Computer, Ph: 02 9674 8166	AMD K6-2 400MHz, 128MB RAM, 5.1GB HD, 36X CD-ROM, 17in	19.4	828	Mar-99
Pioneer 2000 KII 400	$2450	Pioneer Computers, Ph: 02 9690 2888	AMD K6-2 400MHz, 64MB RAM, 10.1GB HD, 36X CD-ROM, 17in	16.5	811	Mar-99
UCT Perfect 4350	$1980	Ultimate Computing Technology, Ph: 02 9584 2896	AMD K6-2 350MHz, 64MB RAM, 5.1GB HD, 32X CD-ROM, 17in	15.0	634	Mar-99
Westan Arrow MII-333	$1999	Westan, Ph: 03 9563 6775	Cyrix MII 333, 64MB RAM, 6.4GB HD, 40X CD-ROM, 17in mon.	14.1	617	Mar-99

Sub-$2000 Desktops

	Price	Vendor/Distributor	The Specs	Winstone 98	CPUMark32	Reviewed
Adelong Advantage K6-2/300	$1995	Adelong Computers, Ph: 1800 626 345	AMD K6-2/300, 4.3GB HD, 64MB SDRAM, 32X CD, 15in mon.	23.5	709	Oct-98
E Beyond Pentium II Spirit	$1990	Beyond Computers, Ph: 02 9417 3688	P200MMX, 2.1GB HD, 32MB SDRAM, 32X CD, 15in monitor	16.0	422	Mar-98
Beyond Super-D Pro	$1990	Beyond Computers, Ph: 02 9417 3688	PII 300, 5.1GB HD, 64MB SDRAM, 32X CD, 15in monitor	24.9	807	Oct-98
Busi-Soft PII 300 Performance	$1999	Busi-Soft, Ph: 03 9890 8900	PII 300, 5.1GB HD, 64MB SDRAM, 32X CD, 15in monitor	23.6	723	Oct-98
Deltacom 2300	$1990	Alfa Computers, Ph: 02 9317 3344	PII 300, 4.2GB HD, 64MB SDRAM, 20X CD, 15in monitor	23.5	772	Oct-98

E Editors Choice Award **M** Merit Award

Deluxe Multimedia Pro	$1920	Queensland IT, Ph: 07 4639 4666	P200MMX, 3GB HD, 32MB SDRAM, 24X CD, 15in monitor	15.7	423	Mar-98
Diamond 300	$1999	Landmark, Ph: 02 9585 9988	PII 300, 4.3GB HD, 64MB SDRAM, 32X CD, 15in monitor	22.2	728	Oct-98
Diamond Lightning 300	$1999	Landmark, Ph: 02 9585 9988	PII 233, 4GB HD, 32MB SDRAM, 24X CD, 15in monitor	17.9	589	Mar-98
Evolution	$1995	Compu Centre, Ph: 03 9642 5999	AMD K6-2/300, 4.5GB HD, 64MB SDRAM, 34X CD, 15in mon.	23.6	797	Oct-98
E Evolution Multimedia Pro	$1995	Compu Centre, Ph: 03 9642 5999	AMD K6/233, 4.1GB HD, 64MB SDRAM, 32X CD, 15in mon	19.1	515	Mar-98
First 6II 300	$1990	Formosa International, Ph: 07 3846 7979	PII 300, 3.2GB HD, 32MB SDRAM, 32X CD, 15in monitor	16.6	475	Mar-98
G&A Thunder C300LX	$1999	G&A Computer Technology, Ph: 02 9740 4256	Celeron 300, 3.2GB HD, 64MB SDRAM, 36X CD, 15in monitor	16.6	726	Oct-98
Mirage Computer System	$1750	Dual Technologies, Ph: 03 9887 7888	Celeron 266, 4.3GB HD, 64MB SDRAM, 32X CD, 15in monitor	15.3	364	Oct-98
Mitac Pursuit PC	$1999	Synnex Australia, Ph: 1300 651 665	Celeron 300, 3.2GB HD, 32MB SDRAM, 32X CD, 15in monitor	15.9	436	Oct-98
Nicola-1MU micro ATX	$1995	Pine Cone Computers, Ph: 1800 804 564	Celeron 266, 3.2GB HD, 64MB SDRAM, 32X CD, 15in monitor	N/A	370	Oct-98
PC Extra Discovery II	$1999	PC Extra, Ph: 02 4722 3711	PII 300, 4.3GB HD, 64MB SDRAM, 32X CD, 15in monitor	23.8	744	Oct-98
Peak Performer II	$1990	Peak Performance Computer, Ph: 02 9690 0822	PII 300, 3.2GB HD, 64MB SDRAM, 32X CD, 15in monitor	22.9	728	Oct-98
M Pioneer 98 PII 300	$1999	Pioneer Computers, Ph: 02 9690 2888	PII 300, 4.3GB HD, 32MB SDRAM, 32X CD, 15in monitor	25.5	809	Oct-98
PowerPro 98 MMX Stealth	$1995	Microarts, Ph: 03 9696 5955	P233MMX, 2.1GB HD, 32MB SDRAM, 24X CD, 15in monitor	16.6	475	Oct-98
Ultimate Perfect	$1850	Ultimate Computing Technology, Ph: 03 9584 2896	Cyrix 6x86MX/PR200, 3.4GB HD, 64MB EDO RAM, 24X CD-ROM, 15in monitor	17.4	441	Mar-98
Ultimate Perfect 5300	$1999	Ultimate Computing Technology, Ph: 03 9584 2896	PII 300, 5.1GB HD, 64MB EDO RAM, 32X CD-ROM, 15in monitor	17.4	441	Mar-98
E Master Series PII/Z33	$1995	Uni Tron Computers, Ph: 03 9819 6677	PII 233, 3GB HD, 32MB SDRAM, 24X CD, 15in monitor	18.6	606	Mar-98
Viewmaster K6/233	$1995	Hallmark Computers, Ph: 03 9562 6789	AMD K6/233, 3GB HD, 32MB SDRAM, 24X CD, 15in monitor	16.8	516	Mar-98
Viewmaster K6-2 3D	$1999	Hallmark Computers, Ph: 03 9562 6789	AMD K6-2/333, 4.3GB HD, 64MB RAM, DVD (opt), 15in mon.	22.6	756	Oct-98
Viewmaster K6/233	$1979	Hallmark Computers, Ph: 03 9562 6789	PII 300, 4.3GB HD, 64MB SDRAM, DVD (opt), 15in monitor	23.0	743	Oct-98

Sub-$3000 Notebooks

	Price	Vendor/Distributor	The Specs	Winstone 98	CPUmark32	Reviewed
E Acer Extensa 500DX	$2799	Acer Computers, Ph: 02 9870 1999	P233 MMX, 2.16GB HD, 32MB RAM, 20X CD, 11in DSTN	15.7	429	Nov-98
Dual MVA-6690	$2995	Dual Technologies, Ph: 03 9887 7888	AMD-K6 300, 2.1GB HD, 32MB RAM, 20X CD, 11in TFT	14.8	525	Nov-98
FirstLite 1130T2	$2980	Formosa International Group, Ph: 07 3846 7976	AMD-K6 300, 2.1GB HD, 32MB RAM, 24X CD, 11in TFT	15.6	599	Nov-98
Leo DesigNote 6100	$2995	First International Computer, Ph: 02 9870 8077	P233 MMX, 2.1GB HD, 32MB RAM, 12X CD, 11in TFT	13.9	429	Nov-98
Pioneer AMD K6-300	$2899	Pioneer Computers, Ph: 02 9690 2888	AMD-K6 300, 3GB HD, 32MB RAM, 10X CD, 11in TFT	16.0	615	Nov-98
Prodigy Notebook	$2995	Integral Computers, Ph: 03 9580 4088	P233 MMX, 2.1GB HD, 64MB RAM, 24X CD, 10in TFT	18.8	625	Nov-98

Networked Computers

	Price	Vendor/Distributor	The Specs	Winstone 98	Word Xper	Reviewed
AcerPower Flex T4000 Net PC	$1150	Acer Computer, Ph: 02 9870 1999	P233MMX, 32MB RAM, 10/100Mbps NIC, 13.8in monitor			Jun-98
Boundless Viewpoint TC Model 200	$1102	MUA, Ph: 02 9928 5111	AMD 5x86/133MHz, 4MB RAM, 10Mbps NIC, 13.5in monitor	48		Jun-98
Compaq Deskpro 4000N	$1895	Compaq, Ph: 1300 368 369	200MMX, 32MB RAM, 10/100Mbps NIC, 13.8in monitor	14.9		Jun-98
Dell OptiPlex N	$2229	Dell, Ph: 1800 808 312	P200MMX, 32MB RAM, 10/100Mbps NIC, 13.8in monitor	16.4		Jun-98
E HP Net Vectra	$2232	Hewlett-Packard, Ph: 13 13 47	P166MMX, 32MB RAM, 10/100Mbps NIC, 14in monitor	15.1		Jun-98
E Neoware @workStation Supra-60	$2569	Conexus, Ph: 02 9975 2799	Intel 80960 RISC/66MHz, 32MB RAM, 10Mbps NIC, 13.7in monitor		51	Jun-98
Tektronix ThinStream 215	$2060	Tektronix, Ph: 02 9888 0100	NEC R4300/100MHz, 24MB RAM, 10/100Mbps NIC, 14in mon.		58	Jun-98
Wyse Winterm 2510SE	$2358	Sealcorp, Ph: 02 9879 8888	AMD SC400 486/66MHz, 8MB RAM, 10Mbps NIC, 14in mon		57	Jun-98
Wyse Winterm 2310SE	$1813	Sealcorp, Ph: 02 9879 8888	AMD SC400 486/66MHz, 8MB RAM, 10Mbps NIC		58	Jun-98

Graphics Workstations

	Price	Vendor/Distributor	The Specs	Winstone High-End	WinBench Graphics	Reviewed
E Compu Centre	$13,990	Compu Centre, Ph: 03 9818 5022	2x PII 333MHz, 128MB SDRAM, 4.5GB HD, 21in monitor	32.2	131.0	Apr-98
Dell Workstation 400	$8829	Dell, Ph: 1800 808 312	PII 300MHz, 128MB RAM, 4GB HD, 17in monitor	25.0	94.2	Apr-98
Microarts	$12,400	Microarts, Ph: 03 9696 5955	2x PII 333MHz, 128MB RAM, 2 x 4.5GB HD, 21in monitor	30.3	132.0	Apr-98
Micron Powerdigm Xsu	$8269	Dytec, Ph: 1800 062 206	2x PII 300MHz, 128MB RAM, 4GB HD, 18in monitor	NA	120.0	Apr-98

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56K V.90 Modems

	Price	Vendor/Distributor	The Specs	TEST.ZIP Transfer Time (sec)	Reviewed
3Com USR Pro Message	$329	CHA, Ph: 03 9251 3111	3Com chip set, stores voice and fax messages	286.5	Mar-99
3Com USR Message	$279	CHA, Ph: 03 9251 3111	3Com chip set, caller ID	250.5	Mar-99
Accura 56K	$289	Hayes Australia Ph: 02 9959 5544	Rockwell chip set	278.5	Mar-99
M AcerModem 56	$189	Servex Australia, Ph: 02 98870 1999	Rockwell chip set	246.5	Mar-99
Banksia MyModem 56V	$249	Sirius Technologies, Ph: 02 9424 2000	Rockwell chip set, WinFax Pro	287.5	Mar-99
Brick 56ei	$299	Auslinx, Ph: 03 9830 6488	Rockwell chip set	267.5	Mar-99
Creative Modem Blaster Flash	$229	Creative Pacific, Ph: 02 9906 9887	Rockwell chip set	252.5	Mar-99
Multitech MT5600ZDX	$375	CHA, Ph: 03 9251 3111	Rockwell chip set	272.5	Mar-99
E Netcomm Roadster II Ultra	$279	Sirius Technologies, Ph: 02 9424 2000	Rockwell chip set	242.5	Mar-99
Netcomm SmartModem 56	$549	Sirius Technologies, Ph: 02 9424 2000	Rockwell chip set	252.0	Mar-99
Netcruiser Fax Modem 56K	$189	Protac Australia, Ph: 02 9637 8999	Rockwell chip set	260.0	Mar-99
SC NetExpress 56	$189	Sirius Technologies, Ph: 02 9424 2000	Rockwell chip set	271.5	Mar-99
Spirit 560SP	$169	Mike Bourne Electronics, Ph: 02 9906 6666	Rockwell chip set	260.0	Mar-99
Patrol 56K Fax Modem	$159	AME, Ph: 02 9749 9788	Rockwell chip set	264.0	Mar-99
M HP DeskJet 720C	$515	Hewlett-Packard, Ph: 13 13 47	600x600 resolution, ColourSmart II technology	0.2	Nov-98
M HP DeskJet 1120C	$949	Hewlett-Packard, Ph: 13 13 47	600x600 resolution, A3 printing	0.5	Nov-98
HP DeskJet 2000CN	$2328	Hewlett-Packard, Ph: 13 13 47	600x600 resolution, networkable	1.1	Nov-98
Lexmark 5000 Jetprinter	$391	Lexmark, Ph: 1800 674 484	1200x600 resolution	0.1	Nov-98
Lexmark 5700 Jetprinter	$478	Lexmark, Ph: 1800 674 484	1200x1200 resolution	0.1	Nov-98
Lexmark OptraC 45	$2250	Lexmark, Ph: 1800 674 484	600x600 resolution, native Postscript printing	0.1	Nov-98

Colour Laser Printers

	Price	Vendor/Distributor	The Specs	Photoshop Print (sec.)	Colour Text Print (sec.)	Reviewed
Brother HL-2400C	$7176	Brother International, Ph: 03 9899 4844	16ppm (black), 4ppm (4-colour)	0.29	0.54	Jun-98
HP LaserJet 5M	$10,206	Hewlett-Packard, Ph: 13 13 47	10ppm (black), 2ppm (4-colour)	0.14	0.86	Jun-98
E QMS Magicolor 2 EX	$7995	QMS, Ph: 02 9901 3235	16ppm (black), 4ppm (4-colour)	0.56	0.82	Jun-98
Xerox Docuprint C55	$7107	Fuji Xerox, Ph: 1300 14 11	12ppm (black), 3ppm (4-colour)	0.19	0.96	Jun-98

Monochrome Laser Printers

	Price	Vendor/Distributor	The Specs	Batch Job Average (ppm)	Reviewed
Brother HL-1660e	$1995	Brother International, Ph: 03 9899 4844	16ppm, 1200x600 resolution	9.34	Jul-98
Epson EPL-N1200	$1999	Epson, Ph: 02 9903 9000	12ppm, 600x600 resolution	11.52	Jul-98
Fujitsu Print Partner 14ADV	$2408	Fujitsu, Ph: 02 9776 4789	14ppm, 600x600 resolution	7.92	Jul-98
Digital LN15N	$3699	Genicom, Ph: 02 9417 6411	14ppm, 2400x600 resolution	7.60	Jul-98
M HP LaserJet 4000TN	$3099	Hewlett-Packard, Ph: 13 13 47	16ppm, 1200x1200 resolution	9.91	Jul-98
Kyocera FS-3700+	$2732	Kyocera, Ph: 02 9906 8075	18ppm, 600x600 resolution	12.39	Jul-98
E Lexmark	$2492	Lexmark, Ph: 02 9930 3555	18ppm, 1200x600 resolution	15.41	Jul-98
Okipage 20n	$2665	IPL Datron, Ph: 02 9698 8211	20ppm, 600x1200 resolution	14.43	Jul-98
QMS 2060 Image Server	$9578	QMS, Ph: 02 9901 3235	20ppm, 600x600 resolution	16.29	Jul-98

Inkjet Printers

	Price	Vendor/Distributor	The Specs	ZD Colour Key (ppm)	Reviewed
Canon BJC-50	$699	Canon Australia, Ph: 02 9805 2000	720x360 resolution, colour scanner, less than one kilogram	0.4	Nov-98
Canon BJC-80	$399	Canon Australia, Ph: 02 9805 2000	720x360 resolution, colour scanner	0.2	Nov-98
Canon BJC-255 SP	$399	Canon Australia, Ph: 02 9805 2000	360x360 resolution, Super Economy Mode	0.3	Nov-98
Canon BJC-4650	$499	Canon Australia, Ph: 02 9805 2000	720x360 resolution, Fluoro ink available	0.3	Nov-98
Canon BJC-5550	$1499	Canon Australia, Ph: 02 9805 2000	720x360 resolution, handles paper up to A3	0.4	Nov-98
Epson Stylus 440	$299	Epson Australia, Ph: 02 9903 9000	720x720 resolution, on-screen status monitor	0.6	Nov-98
Epson Stylus 640	$399	Epson Australia, Ph: 02 9903 9000	1440x720 resolution, on-screen status monitor	0.7	Nov-98
Epson Photo 700	$499	Epson Australia, Ph: 02 9903 9000	1440x720 resolution, on-screen status monitor	0.6	Nov-98
E Epson Stylus 740	$599	Epson Australia, Ph: 02 9903 9000	1440x720 resolution, on-screen status monitor	1.1	Nov-98
Epson Stylus 850	$799	Epson Australia, Ph: 02 9903 9000	1440x720 resolution, on-screen status monitor	1.2	Nov-98
Epson Stylus EX	$899	Epson Australia, Ph: 02 9903 9000	1440x720 resolution, A3 printing	0.5	Nov-98
HP DeskJet 670C	$282	Hewlett-Packard, Ph: 13 13 47	300x300 resolution	0.3	Nov-98

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M HP DeskJet 695C	$335	Hewlett-Packard, Ph: 13 13 47	600x300 resolution, photo cartridge printing	0.3		Nov-98
HP DeskJet 720C	$515	Hewlett-Packard, Ph: 13 13 47	600x600 resolution, ColourSmart II technology	0.2		Nov-98
M HP DeskJet 1120C	$949	Hewlett-Packard, Ph: 13 13 47	600x600 resolution, A3 printing	0.5		Nov-98
HP DeskJet 2000CN	$2328	Hewlett-Packard, Ph: 13 13 47	600x600 resolution, networkable	1.1		Nov-98
Lexmark 5000 Jetprinter	$391	Lexmark, Ph: 1800 674 484	1200x600 resolution	0.1		Nov-98
Lexmark 5700 Jetprinter	$478	Lexmark, Ph: 1800 674 484	1200x1200 resolution	0.1		Nov-98
Lexmark OptraC 45	$2250	Lexmark, Ph: 1800 674 484	600x600 resolution, native Postscript printing	0.1		Nov-98

Multifunction Devices

	Price	Vendor/Distributor	The Specs	10-page colour print (ppm)		Reviewed
M Canon MultiPASS C50	$999	Canon Australia, Ph: 02 9805 2000	200dpi colour inkjet printer, 300dpi scanner, fax	0.9		Feb-99
M HP OfficeJet 710	$999	Hewlett-Packard, Ph: 13 13 47	300dpi colour inkjet printer, 300dpi scanner, fax	1.1		Feb-99
HP LaserJet 3100	$1744	Hewlett-Packard, Ph: 13 13 47	300dpi colour laser printer, 300dpi scanner, fax	N/A		Feb-99
HP OfficeJet Pro 1175C	$2226	Hewlett-Packard, Ph: 13 13 47	600dpi colour inkjet printer, 300dpi scanner, fax	3.9		Feb-99
Oki JetFax M920	$5567	Oki Australia, Ph: 02 9690 8200	600dpi colour laser printer, 300dpi scanner, fax	N/A		Feb-99
Brother MFC 6650MC	$1399	Brother Australia, Ph: 02 9887 4344	300dpi colour laser printer, 300dpi scanner, fax	N/A		Feb-99
E Brother MFC 7160C	$1099	Brother Australia, Ph: 02 9887 4344	300dpi colour inkjet printer, 300dpi scanner, fax	3.6		Feb-99

Digital Cameras

	Price	Vendor/Distributor	The Specs	Recording Medium	Formats	Reviewed
Agfa ePhoto 307	$749	Agfa, Ph: 03 9264 7711	640 x 480, 2in TFT, flash	CompactFlash	JPEG	Mar-98
Agfa ePhoto 780	$799	Agfa, Ph: 03 9264 7711	1024 x 768, 1.8in TFT, flash	CompactFlash	JPEG	Apr-99Oct-98
M Agfa ePhoto 1280	$1690	Agfa, Ph: 03 9264 7711	1280 x 980 , 2in TFT, flash, 3X zoom	SmartMedia	JPEG	Mar-98, Oct-98
Agfa ePhoto 1680	$1999	Agfa, Ph: 03 9264 7711	1600 x 1200, 1.8in TFT, flash, 3X zoom	SmartMedia	JPEG	Apr-99
Canon PowerShot A5 Zoom	$1499	Canon, Ph: 1800 021 167	1024 x 768,2in TFT, flash,2.5 zoom	CompactFlash	JPEG	Apr-99
Canon PowerShot 600	$1299	Canon, Ph: 1800 021 167	832 x 608 , flash	PCMCIA	JPEG, TIFF, WAV	Mar-98
Canon PowerShot Pro 70	$2699	Canon, Ph: 1800 021 167	1536 x 1024,2in TFT, flash,2.5 zoom	CompactFlash	JPEG	Apr-99
Casio QV-100	$899	Shriro, Ph: 02 9370 9100	640 x 480 , 1.8in TFT	Internal	JPEG	Mar-98
Casio QV-300	$999	Shriro, Ph: 02 9370 9100	640 x 480 , 2.5in TFT	Internal	JPEG	Mar-98
Casio QV-700SX	$1599	Shriro, Ph: 02 9370 9100	1280 x 960 , 2.5in TFT,flash,2X zoom	CompactFlash	JPEG	Apr-99
Epson PhotoPC 600	$999	Epson, Ph: 02 9903 9000	1024 x 768, 2in TFT, flash, 3X zoom	Internal	JPEG	Mar-98, Oct-98
M Epson PhotoPC 700	$1299	Epson, Ph: 02 9903 9000	1280 x 960, 2in TFT, flash, 2X zoom	Internal	JPEG	Apr-99Oct-98
Fujifilm DS-300	$3395	Hanimex, Ph: 02 9466 2900	1280 x 1000 , optical view, flash	PCMCIA	JPEG, TIFF	Oct-98
Fujifilm MX-500	$1599	Hanimex, Ph: 02 9466 2900	1280 x 1024,1.8in TFT, flash	SmartMedia	JPEG, TIFF	Apr-99
Fujifilm MX-700	$1699	Hanimex, Ph: 02 9466 2900	1280 x 1024, 2in TFT, flash	Smartmedia	JPEG	Apr-99Oct-98
Kodak DC220	$1995	Kodak, 1800 335 650	1152 x 864, 2in TFT, flash, 2X zoom	CompactFlash	JPEG FLASHPIX	Oct-98
Kodak DC250	$898	Kodak, 1800 335 650	756 x 504, flash, 3X zoom	PCMCIA	Software dependent	Mar-98
Kodak DC260	$2200	Kodak, 1800 335 650	1536 x 1024, 2in. TFT, flash, 3X zoom	CompactFlash	JPEG FLASHPIX	Apr-99Oct-98
Kodak DC120	$1475	Kodak, 03 9350 1222	850 x 984, optic vf, flash, 3X zoom	Internal	Software	Mar-98
E Kodak DC210	$1650	Kodak, 03 9350 1222	1152 x 864, 1.8in TFT, flash, 2X zoom	CompactFlash	JPEG, FlashPix	Mar-98
Kodak DC210 Plus	$1288	Kodak, 03 9350 1222	1152 x 864, 1.8in TFT, flash, 2X zoom	CompactFlash	JPEG, FlashPix	Apr-99
Konica Q-M100V	$1299	Konica, 02 9878 5333	1152 x 872, 1.8in TFT, flash	CompactFlash	JPEG, FlashPix	Apr-99
Leica Digilux	$1850	Adeal, Ph: 03 9369 7811	1280 x 1024,2in TFT, flash	Smartmedia	JPEG	Apr-99
Minolta Dimage V	$1895	Minolta, Ph: 02 9370 8917	640 x 480, 1.8in TFT, flash, 4X zoom	Smartmedia	JPEG	Mar-98
Nikon CoolPix 900	$1299	Maxwell Optical Industries, Ph: 02 9390 0200	1280 x 960, 2in TFT, flash, 3X zoom	CompactFlash	JPEG	Oct-98
Nikon CoolPix 900s	$1899	Maxwell Optical Industries, Ph: 02 9390 0200	1280 x 960, 2in TFT, flash, 3X zoom	CompactFlash	JPEG	Apr-99
Olympus C-840L	$1499	R Gunz Photographic, Ph: 02 9935 6600	1280 x 960, 2in TFT, flash	Smartmedia	JPEG	Oct-98
Olympus C-900 Zoom	$1599	R Gunz Photographic, Ph: 02 9935 6600	1280 x 960, 1.8in TFT, flash,3X zoom	Smartmedia	JPEG	Apr-99
Olympus C-1400XL	$1999	R Gunz Photographic, Ph: 02 9935 6600	1280 x 1024, 1.8in TFT, flash, 3X zoom	Smartmedia	JPEG	Apr-99
Olympus C-1440L	$2499	R Gunz Photographic, Ph: 02 9935 6600	1280 x 1024, 1.8in TFT, flash, 3X zoom	Smartmedia	JPEG	Oct-98
Ricoh RDC-4200	$1499	Ricoh, Ph: 03 9888 7722	1280 x 960, 1.8in TFT, flash, 3X zoom	Smartmedia	JPEG	Apr-99
E Ricoh RDC-4300	$1799	Ricoh, Ph: 03 9888 7722	1280 x 960, 2in TFT, flash, 3X zoom	Smartmedia	JPEG	Apr-99Oct-98

Sony Mavica	$1499	Sony, Ph: 02 9887 6666	640 x 480, 2.5in TFT, flash, 10X zoom	3.5in floppy	JPEG	Mar-98
Sony MVC-FD71	$1699	Sony, Ph: 02 9887 6666	640 x 480, 2.5in TFT, flash, 10X zoom	3.5in floppy	JPEG	Apr-99
Sony MVC-FD81	$1999	Sony, Ph: 02 9887 6666	1024 x 768, 2.5in TFT, flash, 3X zoom	3.5in floppy	JPEG	Apr-99

Flatbed Scanners

	Price	Vendor/Distributor	The Specs	Scan Time (sec)	Interface	Reviewed
Agfa Snapscan 310	$459	Agfa, Ph: 03 9264 7711	300 x 600 optical res., 4800 x 4800 interpolated	43.0	SCSI	Feb-98 / Sep-98
Agfa Snapscan 600	$949	Agfa, Ph: 03 9264 7711	600 x 1200 optical res., 4800 x 4800 interpolated	32.0	SCSI	Feb-98
E HP 6100C	$1339	Hewlett-Packard, Ph: 13 13 47	600 x 600 optical res., 2400 x 2400 interpolated	15.0	SCSI	Feb-98
VuLux VL9600	$199	Innovision, Ph: 03 5831 8833	300 x 600 optical res., 9600 x 9600 interpolated	26.0	Parallel	Feb-98
Primax MediaStorm 4800 Direct II	$289	BBF, Ph: 03 9761 4299	300 x 600 optical res., 4800 x 4800 interpolated	19.0	Parallel	Feb-98
E UMAX Astra 610S	$235	Computer Enterprises, Ph: 03 9510 9040	600 x 300 optical res., 4800 x 4800 interpolated	56.5	SCSI, Parallel	Feb-98
UMAX Astra 1200S	$587	Computer Enterprises, Ph: 03 9510 9040	1200 x 600 optical res., 9600 x 9600 interpolated	26.0	SCSI	Feb-98
AcerScan 8105	$299	Servex, Ph: 02 9870 4868	600 x 1200 optical res., 9600 x 9600 interpolated	17.0	SCSI	Sep-98
Agfa SnapScan EZ	$339	Agfa, Ph: 03 9264 7711	600 x 1200 optical res., 9600 x 9600 interpolated	59.0	Parallel	Sep-98
Artec ViewStation AM12E	$169	Hallmark, Ph: 03 9562 6789	600 x 1200 optical res., 9600 x 9600 interpolated	22.0	Parallel	Sep-98
Epson GT-12000	$6699	Epson, Ph: 02 9903 9000	800 x 800 optical res., 6400 x 6400 interpolated	14.4	SCSI, Parallel	Sep-98
Epson GT-9500	$1999	Epson, Ph: 02 9903 9000	600 x 600 optical res., 4800 x 4800 interpolated	10.0	SCSI, Parallel	Sep-98
M Genius ColorPage Life Pro	$299	BBF, Ph: 03 9761 4299	600 x 1200 optical res., 600 x 1200 interpolated	36.8	Parallel	Sep-98
E HP ScanJet 5100C	$513	Hewlett-Packard, Ph: 13 13 47	300 x 300 optical res., 1200 x 1200 interpolated	28.4	Parallel	Sep-98
IBM Colour Flatbed	$359	IBM, Ph: 02 9951 9601	600 x 1200 optical res., 9600 x 9600 interpolated	43.0	Parallel	Sep-98
ETX 9600UP	$269	Edge, Ph: 02 9353 9200	600 x 1200 optical res., 9600 x 9600 interpolated	52.0	Parallel	Sep-98
Piustek OpticPro 9636T	$299	Creative Pacific, Ph: 02 9906 6887	600 x 1200 optical res., 9600 x 9600 interpolated	27.0	Parallel	Sep-98
UMAX Astra 1220S	$698	Computer Enterprises, Ph: 03 9510 9040	600 x 1200 optical res., 9600 x 9600 interpolated	23.5	SCSI II	Sep-98

Hard Drives

	Price	Vendor/Distributor	The Specs	Cost per GB	Interface	Reviewed
Fujitsu MAB 3091SC	$1517	Fujitsu Australia, Ph: 02 9776 4555	9.1GB, 7200rpm spindle speed, 5 platters	$166.70	UltraSCSI 2	Nov-98
E Fujitsu MAC 3091SC	$1812	Fujitsu Australia, Ph: 02 9776 4555	9.1GB, 10,033rpm spindle speed, 5 platters	$199.12	UltraSCSI 2	Nov-98
M Diamond Max 3400	$899	Maxtor Australia, Ph: 02 9369 3662	13.6GB, 5400rpm spindle speed, 4 platters	$66.10	ATA-4	Nov-98
Diamond Max Plus 2500	$830	Maxtor Australia, Ph: 02 9369 3662	10GB, 7200rpm spindle speed, 4 platters	$83.00	ATA-4	Nov-98
Quantum Viking II	$1028	Quantum Australia, Ph: 02 9232 1999	9.1GB, 7200rpm spindle speed, 5 platters	$113.02	UltraSCSI 2	Nov-98
E Samsung SV0644A	$309	Westan, Ph: 03 9563 6775	6.4GB, 5400rpm spindle speed, 2 platters	$48.28	ATA-4	Nov-98
Seagate Meadlist 10240	$623	Acheva, Ph: 02 9742 3288	10.2GB, 5400rpm spindle speed, 4 platters	$61.08	ATA-4	Nov-98
Seagate Cheetah 9LP	$1950	Acheva, Ph: 02 9742 3288	9.17GB, 10,025rpm spindle speed, 6 platters	$212.65	UltraSCSI 2	Nov-98

Removable Storage

	Price	Vendor/Distributor	The Specs	82MB Backup (min:sec)	Restore	Reviewed
Avatar Shark 250 Mobile Hard Drive	$499	Bits, Ph: 02 9310 3199	Media cost: $66	2:30:00	2:11:00	Jun-98
HP SureStore CD-Writer Plus 7200e	$999	Hewlett-Packard, Ph: 13 13 47	Media cost: $36 (RW)	5:45:00	2:46:00	Jun-98
Imation SuperDisk Parallel Port Drive	$249	Imation, Ph: 1800 225 566	Media cost: $25-$30	11:48:00	5:45:00	Jun-98
Iomega Jaz 2GB	$1099	Iomega, Ph: 02 9955 2455	Media cost: $299	3:38:00	0:35:00	Jun-98
E Iomega ZipPlus	$379	Iomega, Ph: 02 9955 2455	Media cost: $25-$30	2:17:00	1:20:00	Jun-98
SyQuest EZFlyer 230MB	$299	Westan, Ph: 03 9563 6775	Media cost: $59	1:39:00	0:55:00	Jun-98
E SyQuest SparQ 1GB	$399	Westan, Ph: 03 9563 6775	Media cost: $79	0:52:00	0:40:00	Jun-98
SyQuest SyJet 1.5GB	$599	Westan, Ph: 03 9563 6775	Media cost: $159	1:34:00	0:44:00	Jun-98

19in Monitors

	Price	Vendor/Distributor	The Specs	Refresh Rate @ 1600x1200	Reviewed
AcerView 99c	$1253	Servex, Ph: 02 9870 4868	0.26 dot pitch	75Hz	Aug-98
E ADI MicroScan 6P	$1399	AKA Technology, Ph: 02 9630 1588	0.26 dot pitch	75Hz	Aug-98

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CTX 1995UE	$1390	Ocean Office Automation, Ph: 02 9748 6788	0.26 dot pitch	75Hz	Aug-98
Hitachi CM751ET	$2550	Hitachi, Ph: 1800 032 689	0.22 dot pitch	75Hz	Aug-98
MAG InnoVision DJ800	$1586	Magtron, Ph: 02 9975 3727	0.22 dot pitch	65Hz	Aug-98
SyncMaster 900p	$1495	Samsung, Ph: 02 9638 5200	0.25 dot pitch	76Hz	Aug-98
E GDM-400PS	$2459	Sony, Ph: 1800 226 429	0.25 dot pitch	75Hz	Aug-98
ViewMaster M19SL	$1199	Hallmark, Ph: 03 9562 6789	0.26 dot pitch	75Hz	Aug-98
M Viewsonic G790	$2199	Chips and Bits, Ph: 03 9696 1911	0.26 dot pitch	77Hz	Aug-98

21in Monitors

	Price	Vendor/Distributor	Tube Specs	Refresh Rate @ 1600x1200	Reviewed
Brilliance 201B	$2449	Philips Australia, Ph: 02 9742 8311	0.22 dot pitch	85Hz	Feb-99
CM811U	$3199	Hitachi Australia, Ph: 1800 032 689	0.22 dot pitch	75Hz	Feb-99
CM813U	$3199	Hitachi Australia, Ph: 1800 032 689	0.22 dot pitch	71Hz	Feb-99
Innovision DJ920	$2278	Magtron Monitors, Ph: 02 9975 3727	0.28 dot pitch	85Hz	Feb-99
E Microscan 6G	$1799	ADI/AKA, Ph: 03 9562 0022	0.28 dot pitch	75Hz	Feb-99
E Multiscan GDM 500PS	$3250	Sony Australia, Ph: 1800 226 429	0.25 dot pitch	85Hz	Feb-99
PanaSync S110	$2500	Panasonic Australia, Ph: 13 26 00	0.25 dot pitch	85Hz	Feb-99
Syncmaster 1000S	$2810	Samsung Electronics Australia, Ph: 02 9763 9700	0.28 dot pitch	93.75Hz	Feb-99
Viewsonic P815	$3369	Chips and Bits, Ph: 03 9696 1911	0.25 dot pitch	85Hz	Feb-99
Viewsonic P810	$2629	Chips and Bits, Ph: 03 9696 1911	0.25 dot pitch	85Hz	Feb-99
Viewsonic G810	$2579	Chips and Bits, Ph: 03 9696 1911	0.25 dot pitch	73Hz	Feb-99

Flat Panel Displays

	Price	Vendor/Distributor	Tube Specs	Dot Pitch	Reviewed
E Cybercomp Visioneer	$1899	PSI, Ph: 03 9878 8611	15in TFT, 1024 x 768	0.297	Oct-98
Hitachi PCX-DT3131	$5500	Hitachi, Ph: 1800 032 689	13.3in TFT, 1024 x 768	0.26	Feb-98
Mag LS5000C	$2475	Uni Tron, Ph: 03 9819 6677	15in DSTN, 1024 x 768	0.30	Feb-98
Mag LT500C	$3660	Magton Monitors, Ph: 02 9975 3727	15in TFT, 1024 x 768	0.297	Oct-98
Mag LT501C	$4676	Uni Tron, Ph: 03 9819 6677	15in TFT, 1024 x 768	0.30	Feb-98
Magtron PT-1503A	$3775	Magton Monitors, Ph: 02 9975 3727	15in TFT, 1024 x 768 (optional touchscreen)	0.297	Oct-98
M Mitsubishi LXA520W	$2950	Mitsubishi, Ph: 02 9684 7777	15in TFT, 1024 x 768	0.297	Oct-98
NEC Multisync LCD 400V	$5005	NEC, Ph: 1800 812 796	14.1in TFT, 1024 x 768	0.28	Feb-98
M NEC LCD2000	$13,974	NEC, Ph: 1800 812 796	20.1in TFT, 1280 x 1024	0.31	Feb-98
Panasonic PanaFlat LC40	$5660	Panasonic, Ph: 13 26 00	14in TFT, 1024 x 768	0.28	Feb-98
Sony CPD-L150	$3999	Sony Australia, Ph: 1800 226 429	15in TFT, 1024 x 768	0.297	Oct-98
E Samsung SyncMaster 400TFT	$5200	Samsung, Ph: 02 9638 5200	14in TFT, 1024 x 768	0.27	Feb-98
E Samsung SyncMaster 500TFT	$5200	Samsung, Ph: 02 9638 5200	15in TFT, 1024 x 768	0.30	Feb-98
Viewsonic ViewPanel VP140	$5900	Chips and Bits, Ph: 03 9696 1911	14in TFT, 1024 x 768	0.28	Feb-98
Viewsonic ViewPanel VP150	$3995	Chips and Bits, Ph: 03 9696 1911	15in TFT, 1024 x 768	0.297	Oct-98

Personal Data Assistants

	Price	Vendor/Distributor	Tube Specs	OS	Screen	Reviewed
Palm III	$829	3Com, Ph: 1800 644 606	Palm style	PalmOS 3.0	Mono 200x300	Sep-98
Cassiopeia A-20	$999	Shriro, Ph: 02 9370 9100	Keyboard	Windows CE 2.0	Mono 640x240	Sep-98
E Cassiopeia E-10	$699	Shriro, Ph: 02 9370 9100	Palm style	Windows CE 2.0	Mono 240x320	Sep-98
Ericsson MC16	$1599	Ericsson, Ph: 13 17 29	Keyboard with infrared modem phone link	Windows CE 2.0	Mono 640x240	Sep-98
Everex Freestyle Manager	$989	TelePacific, Ph: 1300 657 774	Palm style	Windows CE 2.0	Mono 320x240	Sep-98
HP 620LX	$1597	Hewlett-Packard, Ph: 13 13 47	Keyboard	Windows CE 2.0	Colour 640x240	Sep-98
Nokia 9000 Communicator	$1699	Nokia, Ph: 1300 366 733	Keyboard with phone	GEOS 3.0	Mono 640x200	Sep-98
Philips Velo 500	$1599	Philips, Ph: 1800 144 733	Keyboard	Windows CE 2.0	Mono 640x240	Sep-98
E Psion Series 5	$1099	Vodaphone, Ph: 02 9415 7777	Keyboard	EPOC32	Mono 640x240	Sep-98
Rex-3	$300	Franklin Electronic Publishing, Ph: 1800 882 589	Card style	Proprietary	Mono 8 lines	Sep-98
Sharp HC-4500A	$1499	Sharp, Ph: 02 9830 4800	Keyboard style	Windows CE 2.0	Colour 640x320	Sep-98
Sharp MC-G1	$1099	Sharp, Ph: 02 9830 4800	Phone with organiser	Proprietary	Mono 160x239	Sep-98

Graphics Cards

	Price	Vendor/Distributor	The Specs	Graphics WinMark 98	Card Type	Reviewed
Canopus Total3D 128V	$399	Innovision, Ph: 03 5831 8833	AGP, nVidia RIVA 128, 4MB	102	(PCI)	Aug-98
Creative Blaster Exxtreme	$249	Creative Pacific, Ph: 02 9906 8887	PCI, 3Dlabs Permedia 2, 4MB (8MB)	112.0	(PCI)	Aug-98
Creative Blaster RivaTNT	$489	Creative Pacific, Ph: 02 9906 8887	AGP, Riva TNT, 16MB	N/A		Nov-98
Creative Voodoo2 3D	$399	Creative Pacific, Ph: 02 9906 8887	PCI, 3Dfx Voodoo2, 8MB	N/A	(PCI)	Aug-98
Diamond Stealth II G460	$349	Chips and Bits, Ph: 03 9696 1911	AGP, Intel i740, 8MB	137.0	(AGP)	Aug-98
Diamond Stealth II S220	$249	Chips and Bits, Ph: 03 9696 1911	PCI, Rendition V2100, 4MB	118	(PCI)	Aug-98
E Diamond Monster 3D II	$449	Chips and Bits, Ph: 03 9696 1911	PCI, 3Dfx Voodoo2, 8MB	N/A	(PCI)	Aug-98
E Diamond Monster Fusion	$399	Chips and Bits, Ph: 03 9696 1911	AGP/PCI, Banshee, 16MB	N/A		Nov-98
Diamond Viper V330	$349	Chips and Bits, Ph: 03 9696 1911	AGP, nVidia RIVA 128, 4MB	109	(PCI)	Aug-98
Diamond Viper V550	$459	Chips and Bits, Ph: 03 9696 1911	AGP/PCI, Riva TNT, 16MB	N/A		Nov-98
Diamond Fire GL 1000 Pro	$499	Chips and Bits, Ph: 03 9696 1911	AGP, 3Dlabs Permedia 2, 8MB	138	(PCI)	Aug-98
Hercules 3D Thriller	$449	PSI, Ph: 03 9878 8611	AGP, Rendition V2200, 8MB	120.0	(AGP)	Aug-98
Hercules Beast	$269	PSI, Ph: 03 9878 8611	AGP2, S3 Savage, 8MB	N/A		Nov-98
Hercules Dynamite 3D/GL	$399	PSI, Ph: 03 9878 8611	AGP, 3Dlabs Permedia 2, 8MB	149	(AGP)	Aug-98
Hercules Stingray 2	$449	PSI, Ph: 03 9878 8611	PCI, 3Dfx Voodoo2, 12MB	N/A		Nov-98
Hercules Terminator 2XI	$255	PSI, Ph: 03 9878 8611	AGP, Intel i740, 8MB	127.0	(AGP)	Aug-98
Leadtek Winfast 3D L2300	$275	Tech-Excel Distribution, Ph: 02 9417 7898	AGP, 3Dlabs Permedia 2, 8MB	120	(AGP)	Aug-98
Leadtek Winfast 3D S900	$275	Tech-Excel Distribution, Ph: 02 9417 7898	AGP2, Intel i740, 8MB	120.0	(AGP)	Aug-98
Legend Neon AGP	$109	Legend Technology, Ph: 08 8374 2355	AGP, S3 Trio 3D, 4MB	96.0	(AGP)	Aug-98
E Matrox	$156	Focal Point Computing, Ph: 03 9525 1144;	AGP2, Matrox G200, 8MB	160.0	(AGP)	Aug-98/
Millenium G200		Compucon, Ph: 02 9417 7166				Nov-98
Matrox Productiva G100	$207	Focal Point Computing, Ph: 03 9525 1144, Compucon, Ph: 02 9417 7166	AGP, Matrox G100, 8MB	143.0	(AGP)	Aug-98
Orchid Righteous 3D II	$645	Q*Soft, Ph: 1300 658 658	PCI, 3Dfx Voodoo2, 12MB	N/A	(PCI)	Aug-98

Sound Cards

	Price	Vendor/Distributor	The Specs	16-bit sampling range	SN Ratio	Reviewed
E Sound Blaster AWE Gold	$399	Creative Pacific, Ph: 02 9906 8887	ISA, 64 sim. voices, Creative V 32D chipset	5Hz-44.1kHz	>90dB	Feb-98
Monster Sound	$349	Chips and Bits, Ph: 03 9696 1911	PCI, 32 sim. voices, Analog Devices chipset	8Hz-48kHz	>92dB	Feb-98
Ensoniq Audio PCI	$249	Electric Factory, Ph: 03 9480 5988	PCI, 32 sim. voices, AKM-4531 chipset	5Hz-48kHz	>90dB	Feb-98
Aztech SC128-3D	$149	Westan, Ph: 03 9563 6775	PCI, 128 sim. voices, S3 Sonic Vibes chipset	5Hz-48kHz	>80dB	Jul-98
Creative Blaster PCI 64	$249	Creative Pacific, Ph: 02 9906 8887	PCI, 64 sim. voices, Ensoniq ES1370 chipset	4Hz-48kHz	>90dB	Jul-98
E Monster Sound MIDI	$249	Chips and Bits, Ph: 03 9696 1911	PCI, 32 sim. voices, Diamond Freedom 5600	400Hz-48kHz	>90dB	Jul-98
Monster Sound MX200	$349	Chips and Bits, Ph: 03 9696 1911	PCI, 64 sim. voices, Diamond Freedom 5600 chipset	400Hz-48kHz	>90dB	Jul-98
Diamond Sonic Impact	$149	Chips and Bits, Ph: 03 9696 1911	PCI, 64 sim. voices, ESS Maestro-2 chipset	400Hz-48kHz	>90dB	Jul-98
Videologic Sonic Storm	$159	Sysink, Ph: 1800 067 722	PCI, 64 sim. voices, ESS Maestro-1 chipset	8Hz-48kHz	85dB	Jul-98
Yamaha Waveforce	$179	Peripheral Sources International, Ph: 03 9878 8611	PCI, 64 simultaneous voices, Yamaha XGYMF724C-V chipset	5Hz-48kHz	80dB	Jul-98

PC Speakers

	Price	Vendor/Distributor	The Specs	Reviewed
4Q Sound Image Jr	$144	Powersource Australia, Ph: 02 9748 8600	10 watts/channel	Feb-98
E Altec Lansing ACS48	$299	Innovision, Ph: 03 5831 8833	20 watts/channel	Feb-98
E Altec Lansing ACS45	$199	Innovision, Ph: 03 5831 8833	10 watts/channel	Feb/Dec-98
E Altec Lansing ADA305	$349	Innovision, Ph: 03 5831 8833	5 watts/channel + 20 watts for subwoofer	Dec-98
Bose MediaMate	$799	Bose Australia, Ph: 02 9204 6111		Feb-98
Boston Acoustics Media Theatre	$599	Hi Fi & Video Marketing, Ph: 02 9319 6877		Dec-98
Boston Acoustics MicroMedia	$399	Hi Fi & Video Marketing, Ph: 02 9319 6877		Feb/Dec-98
E Cambridge Soundworks	$499	Creative Pacific, Ph: 02 9906 8887		Feb-98
Cambridge PCWorks	$249	Creative Pacific, Ph: 02 9906 8887		Feb-98

E Editors Choice Award **M** Merit Award

Cambridge PCWorks FourPointSurround	$299	Creative Pacific, Ph: 02 9906 8887	4 x 3.5 watts + 10 watts for subwoofer	Dec-98
Edifier R2000AT 3D	$349	DPC Enterprises, Ph: 03 9418 3948	15 watts/channel	Dec-98
Edifier R3000AT	$349	DPC Enterprises, Ph: 03 9418 3948		Dec-98
Edifier R800ATC	$119	DPC Enterprises, Ph: 03 9418 3948	5 watts/channel	Dec-98
Labtec LCS-1022	$99	Westan, Ph: 03 9563 6775	2.5 watts/channel	Feb-98
PS SW-101	$195	Powersource Corporation, Ph: 02 9748 8600	2 x 10 watts + 35 watts for subwoofer	Dec-98
PS SW-102	$139	Powersource Corporation, Ph: 02 9748 8600	2 x 10 watts + 20 watts for subwoofer	Dec-98
Roland MA-4	$149	Roland Australia, Ph: 02 9982 8266	4 watts/channel	Dec-98
Roland MA-8	$199	Roland Australia, Ph: 02 9982 8266	8 watts/channel	Dec-98
Roland MA-9	$279	Roland Australia, Ph: 02 9982 8266	8 watts/channel	Dec-98
Roland MA-20	$299	Roland Australia, Ph: 02 9982 8266	15 watts/channel	Dec-98
Videologic Scirocco	$975	Videologic Upgrade Centre, Ph: 03 9722 2089	2 x 10W (mid), 2 x 10W (tweeters) + 40W for sub	Dec-98
Yamaha YST-100	$299	Yamaha Music Australia, Ph: 1800 805 413	20 watts/channel	Dec-98
Yamaha YST-M7	$99	Yamaha Music Australia, Ph: 1800 805 413	5 watts/channel	Dec-98
Yamaha YST-M15	$129	Yamaha Music Australia, Ph: 1800 805 413	10 watts/channel	Dec-98
Yamaha YST-M20DSP	$159	Yamaha Music Australia, Ph: 1800 805 413	10 watts/channel	Dec-98
Yamaha YST-MSX5	$199	Yamaha Music Australia, Ph: 1800 805 413	5 watts/channel + 15 watts for subwoofer	Dec-98

PC Game Controllers

	Price	Vendor/Distributor	The Specs	Reviewed
SideWinder FF Pro	$199	Microsoft Australia, Ph: 13 20 58	Force Feedback joystick, eight buttons, eight-way hat switch	Dec-98
SideWinder Precision Pro	$129	Microsoft Australia, Ph: 13 20 58	Joystick, digital-optical technology	Dec-98
SideWinder Analogue	$63	Microsoft Australia, Ph: 13 20 58	Standard analogue joystick	Dec-98
SideWinder FF Wheel	$399	Microsoft Australia, Ph: 13 20 58	Force Feedback steering wheel and pedals	Dec-98
Genius Flight 2000 F-22	$70	Canda International, Ph: 02 9565 4199	Joystick	Feb-98
Genius MaxFire G-07	N/A	Canda International, Ph: 02 9565 4199	Game pad	Feb-98
Eagle Touch JST-200	$89	APCA, Ph: 03 9763 8200	Joystick	Feb-98
Eagle Touch GP-50	$69	APCA, Ph: 03 9763 8200	Game pad	Feb-98
Logitech WingMan Force	$269	Logitech, Ph: 02 9972 3711	Force Feedback joystick	Feb-98
Cobra USB Gamepad	$80	Creative Pacific, Ph: 02 9906 8887	Game pad	Feb-98
Sainix X36 Flight and Thrust	$350	Innovision, Ph: 03 5831 6633	Joystick and thrust controller bundle	Feb-98
F-16 Combat Stick	$180	Action Hi-Tech, Ph: 03 9808 2100	CH Products joystick	Feb-98
Jane's Combat Stick	$220	Action Hi-Tech, Ph: 03 9808 2100	CH Products joystick	Feb-98

CD-ROM Writers

	Price	Vendor/Distributor	The Specs	CD-ROM WinMark 98	Copy (time)	Reviewed
HP SureStore CD-Writer Plus 7100e	$979	Hewlett-Packard, Ph: 13 13 47	Parallel interface, 2.5MB/sec transfer rate	274.0	24:37:03	Feb-98
E Nomai 680 RW	$1099	Tech-Excel, Ph: 02 9417 7898	SCSI-2 interface, 5MB/sec transfer rate	365.0	20:00:00	Feb-98
Ricoh MP6200S	$1095	NRG, Ph: 9939 0809	SCSI-2 interface, 5MB/sec transfer rate	548.0	12:00:00	Feb-98
M Yamaha CDR401T	$962	Synnex, Ph: 03 9540 0555	EIDE interface, 5.5MB/sec transfer rate	527.0	11:55:00	Feb-98
Yamaha CRW4001T	$1348	Synnex, Ph: 03 9540 0555	EIDE interface, 2MB/sec transfer rate	479.0	17:08:01	Feb-98

AGP Motherboards

	Price	Vendor/Distributor	The Specs	Winstone 98	CPUmark32	Reviewed
Abit AB-LX6	$320	Synnex, Ph: 03 9540 0555	Slot 1, Intel 440LX, Max. RAM: 512MB SDRAM/1GB EDO	22.9	821	Apr-98
AME P5AXA	$268	AME Group, Ph: 02 9749 9788	Slot 1, Intel 440LX, Max. RAM: 512MB SDRAM/EDO	22.9	830	Apr-98
EPOX KP6-LA	$180	Zeus Technology, Ph: 08 9321 8969; Hi-Tech, Ph: 03 9574 9166	Slot 1, Intel 440LX, Max. RAM: 512MB SDRAM/1GB EDO	22.5	802	Apr-98
FIC PA-2012	$250	FIC, Ph: 02 9748 4566	Socket 7, Via Apollo VP3, Max. RAM: 256MB SDRAM/EDO	16.3	449	Apr-98
FIC VA-503	$215	FIC, Ph: 02 9748 4566	Socket 7, Via Apollo VP3, Max. RAM: 512MB SDRAM/EDO	13.8	385	Apr-98
Intel 440LX	$315	Intel, Ph: 03 9540 0555	Slot 1, Intel 440LX, Max. RAM: 384MB SDRAM	21.4	803	Apr-98
E Lucky Star 6ALX2	$238	Tinco International, Ph: 03 9696 6244	Slot 1, Intel 440LX, Max. RAM: 384MB SDRAM/768MB EDO	23.7	919	Apr-98
E MS5169	$729	Mystar, Ph: 02 9868 6962	Socket 7, Aladdin 5, Max. RAM: 384MB SDRAM/768MBEDO	16.3	405	Apr-98
MS6117	$290	Mystar, Ph: 02 9868 6962	Slot 1, Intel 440LX, Max. RAM: 384MB SDRAM/768MB EDO	21.7	821	Apr-98

Stallion M66B	$985	MBI, Ph: 02 9773 0055	Slot 1, Intel 440LX, Max. RAM: 512MB SDRAM/1GB EDO	22.4	815	Apr-98
Legend P6I440LX	$330	QDI, Ph: 03 9558 9280, Spear Technology, Ph: 03 9558 9431	Slot 1, Intel 440LX, Max. RAM: 512MB SDRAM/1GB EDO	22.6	817	Apr-98
SuperMicro P6DLS	$729	BCN Technology, Ph: 02 9417 3688	Slot 1, Intel 440LX, Max. RAM: 512MB SDRAM/1GB EDO	22.2	797	Apr-98
SuperMicro SL4	$302	BCN Technology, Ph: 02 9417 3688	Slot 1, Intel 440LX, Max. RAM: 512MB SDRAM/1GB EDO	22.2	806	Apr-98

BX Motherboards

	Price	Vendor/Distributor	The Specs	Winstone Business	GPUmark32	Reviewed
Abit AB-BX6	$339	Synnex, Ph: 03 9540 0555	66/75/83.3/100/103/112/133.3	4.04	1010	Sep-98
Appen AX6B	$299	Servex, Ph: 02 9870 4668	66/68.5/75/83.3/100/103/112/133.3	3.95	980	Sep-98
Asus P2B-LS	$530	Tech-Excel, Ph: 02 9417 7898	50/66.8/75/83.3/100/103/112	4.04	994	Sep-98
Chaintech 6BTM	$275	Adelong, Ph: 1800 626 345	66/100	3.89	992	Sep-98
EPoX EP-61BXA-M	$249	Westan, Ph: 03 9463 6775	66/100	3.94	1020	Sep-98
Gigabyte GA-686BX	$269/$295	BBF, Ph: 03 9761 4299, Global Business, Ph: 02 9644 3900	66/100	3.99	1030	Sep-98
E Iwill 6D100	$290	COM1 International, Ph: 03 9532 4717	66/75/83/100/112/133.3	4.12	1000	Sep-98
Iwill 6S100	$535	COM1 International, Ph: 03 03 9532 4717	66/75/83/100/112/133.3	4.07	1040	Sep-98
Lucky Star 5ABX2V	$269	Times International, Ph: 03 9696 8244	66.6/75/83/100/103/112/133.3	4.05	1020	Sep-98
M6TBC	$350	Edge, Ph: 02 9353 9200	66/100	4.02	1030	Sep-98
MSI MS-6116	$315	MSI, Ph: 02 9476 3117	66/68.5/75/83.3/100/103/112	4.11	996	Sep-98
MSI MS-6119	$305	MSI, Ph: 02 9476 3117	66/68.5/75/83.3/100/103/112	4.04	1040	Sep-98
PC Partner BXA808D	$254	BCN Technology, Ph: 02 9417 3688	66/100	3.91	1020	Sep-98
P61440BX Brilliant 1	$268	QDI, Ph: 03 9558 9280	66/100	3.90	980	Sep-98
Supermicro Super P6SBA	$327	BCN Technology, Ph: 02 9417 3688	66/100	4.06	999	Sep-98
Supermicro Super P6SBS	$605	Tech-Excel, Ph: 02 9417 7898	66/100	4.03	1020	Sep-98
SuperPower SP-PII BXA	$280	MoMo Technology, Ph: 07 3376 9631	66/100	3.96	979	Sep-98
Tekram P6B40-A4X	$299	Lan1, Ph: 1300 301 053	66/100	3.96	994	Sep-98
Tyan Tsunami S1846S	$389	Chips and Bits, Ph: 03 9696 1911, IPS, Ph: 02 9923 1777	66/100	3.96	995	Sep-98
Umax UMB-440BX	$319	PSI, Ph: 03 9510 9040	66/100	3.92	989	Sep-98

Servers

	Price	Vendor/Distributor	The Specs	ServerBench Proc. Mix (32 clients)	Reviewed
AcerAltos 9100	$12,110	Acer Computer, Ph: 02 9870 1999	PII 266MHz, 128MB EDO RAM, 4.3GB HD	15.6	Jun-98
DeltaCom PII Server	$10,990	Alfa Computers, Ph: 02 9317 3344	PII 266MHz, 128MB SDRAM, 4.5GB HD	16.0	Jun-98
Digital Server 3000	$11,460	Digital, Ph: 02 9561 7428	PII 266MHz, 128MB EDO RAM, 2 x 4.5GB HD	15.4	May-98
Evolution Ultra Pro	$9995	Compu Centre, Ph: 03 9642 5999	PII 266MHz, 128MB SDRAM, 2 x 4.5GB HD	16.4	May-98
E Express 5800/130A Pro	$12,674	NEC, Ph: 13 15 32	Pentium Pro 200MHz, 128MB EDO RAM, 4.2GB HD	15.0	Jun-98
E HP LC II	$8200	Hewlett Packard, Ph: 13 13 47	PII 266MHz, 128MB ECC RAM, 4.26GB HD	15.1	May-98
Power Pro Server	$10,990	Microarts, Ph: 03 9696 5955	PII 266MHz, 128MB SDRAM, 4.5GB HD	16.4	Jun-98
Ultra PII BX Server	$5520	Beyond Computers, Ph: 02 9417 3688	PII 266MHz, 128MB SDRAM, 4.2GB HD	17.0	Jun-98

Xeon Remote Access Servers

	Price	Vendor/Distributor	The Specs	ServerBench Proc. Mix (32 clients)	Reviewed
Hyperion 2450D	$7999	Compucon, Ph: 02 9417 7898	PII Xeon 450, 256MHz,	34.0	Apr-99
Poweredge 6300	$28,283	Dell, Ph:1800 812 393	PII Xeon450, 512MHz,	34.0	Apr-99
Xeon 450 System	$6210	Elite Industries Group, Ph: 02 9898 0222	PII Xeon450,128MHz	35.1	Apr-99
ALR 8300	$15,644	Gateway Ph: 1800 500 916	PII Xeon450, 512 KB,256 MHz	33.8	Apr-99
E HP NetServer LH4	$18,593	Hewlett Packard, Ph: 1800 500 916	PII Xeon400,1MB,256MHz,	31.8	Apr-99
Intel C8000r	$32,565	IPEX, Ph: 03 9242 5000	xeon 450, 512KB,2GB		Apr-99

Clustered Servers

	Price	Vendor/Distributor	The Specs	Failover Time (seconds)	Reviewed
Data General AViioN NT	$127,000	Data General, Ph: 03 9698 6988	4 x Pentium Pro 200MHz, 10 x 4GB disk array	27	Jun-98
Dell PowerEdge Cluster	$74,176	Dell, Ph: 1800 808 312	2 x Pentium Pro 200MHz, 8 x 4GB disk array	25	Jun-98

E Editors Choice Award **M Merit Award**

Digital Server 3200 and RAID Array 310	$35,373	Digital, Ph: 02 9561 5252	2 x Pentium II 266MHz, 7 x 2.1GB disk array	28	Jun-98
HP NetServer LHII and AutoRAID	$128,100	Hewlett-Packard, Ph: 13 13 47	2 x Pentium II 300MHz, 7 x 9.1GB + 10 x 4GB disk array	24	Jun-98

Small Office Networking

	Price	Vendor/Distributor	The Specs	Reviewed
Cisco Networked Office Stack	various	Cisco, Ph: 02 9935 4100	Hubs, switches, routers and peripherals	Jul-98
D-Link Office	various	D-Link, Ph: 02 9417 7100	Hubs, switches, routers and peripherals	Jul-98
Intel InBusiness	various	Intel, Ph: 02 9937 5800	Hubs, switches, routers and peripherals	Jul-98
E NetGear	various	Bay Networks, Ph: 02 9927 8888	Hubs, switches, routers and peripherals	Jul-98
3Com OfficeConnect	various	3Com, Ph: 02 9956 6247	Hubs, switches, routers and peripherals	Jul-98

Networking Kits

	Price	Vendor/Distributor	The Specs	Reviewed
3Com OfficeConnect	$310	3Com, Ph: 02 9956 6247	10Mbps Ethernet, ISA	Oct-98
D-Link DE-905	$228	D-Link Australia, Ph: 02 9417 7100	10Mbps Ethernet, ISA	Oct-98
NDC SOHOware	$199	Intresource, Ph: 02 9807 6999	10Mbps Ethernet, PCI	Oct-98
NDC SOHOware Fast	$249	Intresource, Ph: 02 9807 6999	100Mbps Ethernet, PCI	Oct-98
E NetGear SB 104	$249	Bay Networks, Ph: 02 9927 8888	10Mbps Ethernet, PCI	Oct-98
Radio Lan/10	$960	OMNIconnect, Ph: 03 9787 0122	10Mbps radio frequency, ISA	Oct-98
WebGear Aviator Wireless	$630	MIMP, Ph: 08 8297 2088	150Kbps radio frequency, Parallel	Oct-98

Web Server Appliances

	Price	Vendor/Distributor	The Specs	Reviewed
Micro Webserver 200	$2006	Cisco, Ph: 02 9935 4100	IBM PowerPC 403GA, 2.1GB HD, Vxworks OS	Sep-98
E Cobalt Qube2699	$2699	Lidcam, Ph: 03 9820 9077	MIPS 5230R, 2.1GB HD, Linux 2.0.27	Sep-98
Microtest Webzerver	$3760	SCSI Corp., Ph: 02 9894 6033	AMD 5x86, 2.1GB HD, Linux 2.0.27	Sep-98

Print Servers

	Price	Vendor/Distributor	The Specs	Print Test (sec)	Reviewed
Axis PrintPoint 560/100	$810	Intexigent Technologies, Ph: 02 9891 6611	Ports: 2 parallel, 1 serial, 10/100Mbps auto-sensing	88.0	Mar-98
D-Link DP-300	$695	D-Link, Ph: 02 9417 7100	Ports: 2 parallel, 1 serial, 10/100Mbps auto-sensing	93.0	Mar-98
Emulex NETQue PRO2	$917	XSI Technology, Ph: 02 9879 7211	Ports: 2 parallel, 1 serial, 10Mbps	99.0	Mar-98
JetDirect EX Plus3	$968	Hewlett-Packard, Ph: 13 13 47	Ports: 3 parallel, 10Mbps	83.0	Mar-98
E NetPortExpress PRO/100	$877	Intel, Ph: 02 9937 5800	Ports: 2 parallel, 1 serial, 10/100Mbps auto-sensing	96.0	Mar-98
MarkNet Pro 3	$706	Lexmark, Ph: 1800 674 484	Ports: 2 parallel, 1 serial, 10/100Mbps auto-sensing	91.0	Mar-98
DPI NETPrint 1000	$1639	Digital Networks Australia, Ph: 02 9437 5177	Ports: 2 parallel, 1 serial, 10Mbps	87.0	Mar-98

Uninterruptible Power Supplies

	Price	Vendor/Distributor	The Specs	Run-down Time mm:ss	Reviewed
APC Smart-UPS 1000	$1500	American Power Conversion, Ph: 1800 652 725	VA rating: 1000, Watts: 670	36:15	Jan-99
NetUPS PRM700i-RM	$1061	BTR Power Systems, Ph: 02 9878 5000	VA rating: 700, Watts: 420	25:26	Jan-99
OPTI-UPS Power PS 600ps	$659	Chips and Bits, Ph: 03 9696 1911	VA rating: 800, Watts: 500	28:45	Jan-99
M OPTI-UPS Power PS 650es	$419	Chips and Bits, Ph: 03 9696 1911	VA rating: 650, Watts: 410	22:00	Jan-99
PS1000MT-230	$1505	Liebert Corporation, Ph: 02 9743 8555	VA rating: 1000, Watts: 670	35:40	Jan-99
M UPStation GXT1000MT	$2178	Liebert Corporation, Ph: 02 9743 8555	VA rating: 1000, Watts: 700	37:02	Jan-99
E Sola UPS 320	$826	Sola Australia, Ph: 02 9706 5662	VA rating: 750, Watts: 470	31:07	Jan-99
LANsaver LS-MT1000	$1214	Upsonic Power, Ph: 03 9764 0074	VA rating: 1000, Watts: 670	35:25	Jan-99

Videoconferencing Kits

	Price	Vendor/Distributor	PC video capture resolution	Lens(max aperture)	Reviewed
VCAM	$209	AME Group Aust, Ph: 02 9749 9788	640 x 480	f2.0	Apr-99
E RTX Videoconferencing kit	$329	Edge Technology, Ph: 02 9353 9200	640 x 480	f2.0	Apr-99
C.U.C.U.S Videoconferencing	$385	Elite Industries Group, Ph: 02 9899 0222	640 x 480	f2.0	Apr-99
QuickCam Home	$249	Logitech Australia, Ph: 02 9972 3711	352 x 288	f2.0	Apr-99
QuickCam Pro	$349	Logitech Australia, Ph: 02 9972 3711	640 x 480	f2.0	Apr-99
QuickCam VC	$199	Logitech Australia, Ph: 02 9972 3711	352 x 288	f2.0	Apr-99
LiveLAN H.323/T.120	$2807	PictureTel Australia, Ph: 02 9978 8000	352 x 288	f2.0	Apr-99

Desktop VC PCB500P	$3038	Sony Australia, Ph: 02 9887 6666	352 x 288	11.8		Apr-99
Captivator PCI/VC	$595	Videologic Upgrade Centre Ph: 03 9722 2089	320 x 240	12.0		Apr-99

Server NICs

	Price	Vendor/Distributor	The Specs	Number of Ports	Max. Boards per Server	Reviewed
Adaptec ANA-69011	$169	Anabelle Bits, Ph: 02 9384 8000	Adaptec Ethernet controller chip	1	8	Nov-98
Adaptec ANA-6922	$735	Anabelle Bits, Ph: 02 9384 8000	DEC Ethernet controller chip	2	8	Nov-98
Compaq NC3122	$520	Compaq, Ph: 1800 368 369	Intel Ethernet controller chip	2	Dep. on server	Nov-98
E Intel PRO/100+	$258	Intel, Ph: 02 9937 5800	Intel Ethernet controller chip	1	Unlimited	Nov-98
Intel PRO/100 Intelligent	$866	Intel, Ph: 02 9937 5800	Intel Ethernet controller chip	1	Unlimited	Nov-98
Matrox 100 Multiport NIC	$1131	Similkmeen Dist, Ph: +64 9577 2963	DEC Ethernet controller chip	4	4	Nov-98
Matrox 100 Multiport NIC+	$1998	Similkmeen Dist, Ph: +64 9577 2963	DEC Ethernet controller chip	4	4	Nov-98
3Com Fast Ethernet Server NIC	$243	3Com Australia, Ph: 1800 644 606	3Com Ethernet controller chip	1	16	Nov-98

Personal ISDN Routers

	Price	Vendor/Distributor	The Specs	Two-client Combined FTP Copy	Reviewed
ACC Congo Router	$1100	XSI Technology, Ph: 02 9879 7211	Up to 4 users	119.5	Jul-98
Ascend Pipeline 75	$1656	Ascend Communications, Ph: 03 9656 7000	Unlimited users	117.5	Jul-98
Bay Networks Nautica 200	$1400	Bay Networks, Ph: 02 9927 8888	Unlimited users	120.0	Jul-98
Cisco 766M-G2	$1989	Cisco, Ph: 02 9935 4100	Up to 4 users	122.6	Jul-98
M Shiva Access Port 2.0	$2000	Shiva, Ph: 02 9959 2296	Up to 16 users	115.4	Jul-98
WebRamp Entre	$1490	Anabelle Bits, Ph: 02 9384 8000	Up to 253 users	119.4	Jul-98
ZyXel Prestige 100	$750	KNX Asia Pacific, Ph: 03 9629 3800	Unlimited users	119.7	Jul-98
ZyXel Prestige 128	$880	KNX Asia Pacific, Ph: 03 9629 3800	Unlimited users	118.9	Jul-98

Fast Ethernet Hubs

	Price	Vendor/Distributor	The Specs	Repeater	Reviewed
BayStack 202	$3474	Bay Networks, Ph: 02 9927 8888	100Mbps, 12 ports. Max. managed: 8 hubs, 96 ports	Class I	Apr-98
Netelligent 3612	$4610	Compaq, Ph: 1300 368 369	100Mbps, 12 ports. Max. managed: 5 hubs, 60 ports	Class I	Apr-98
AdvanceStack 12TXM	$4323	Hewlett-Packard, Ph: 13 13 47 1	100Mbps, 12 ports. Max. managed: 5 hubs, 60 ports	Class I	Apr-98
E Intel Express	$2198	Intel, Ph: 02 9937 5800	10/100Mbps, 12 ports. Max. managed: 8 hubs, 96 ports	Class I	Apr-98
SMC TigerStack 100 5312TX	$2374	Harris Technology, Ph: 02 9957 1142	100Mbps, 12 ports. Max. managed: 8 hubs, 96 ports	Class I	Apr-98
3Com SuperStack II	$1856	3Com, Ph: 02 9956 6247	100Mbps, 12 ports. Max. managed: 7 hubs, 91 ports	Class II	Apr-98

Auto-Sensing Switches

	Price	Vendor/Distributor	The Specs	Broadcast Latency (ms, 640 Byte Frame)	(1518 Byte Frame)	Reviewed
Accton Fast SwitcHub-8mi	$3074	Anabelle Bits, Ph: 02 9384 8000	Managed, Accton chip set	14	130	Aug-98
Allied Telesyn CentreCOM AT-FS708	$3311	Express Data, Ph: 02 9598 9100	Unmanaged, Galileo chip set	22	188	Aug-98
Asante FriendlyNET FS4008DS	$1299	Conexus, Ph: 02 9975 2799	Unmanaged, Galileo chip set	17	188	Aug-98
Cisco 1548 MicroSwitch	$3440	Cisco, Ph: 02 9935 4100	Unmanaged, Galileo chip set	17	188	Aug-98
Cisco Catalyst 2908XL	$4135	Cisco, Ph: 02 9935 4100	Managed, Cisco chip set	16	132	Aug-98
Compaq Netelligent 5708TX	$3288	Compaq, Ph: 1300 368 369	Managed, Accton chip set	14	130	Aug-98
D-Link DES-1008	$2206	D-Link, Ph: 02 9417 1077	Unmanaged, Galileo chip set	17	188	Aug-98
D-Link DES-3208	$3834	D-Link, Ph: 02 9417 1077	Managed, Galileo chip set	21	263	Aug-98
Farallon Fast Starlet Switch	$1580	Lidcam, Ph: 03 9820 9077	Unmanaged, Galileo chip set	17	189	Aug-98
NetGear FS508	$2099	Bay Networks, Ph: 02 9927 8888	Unmanaged, Accton chip set	14	130	Aug-98
SMC Tigerswitch 6608T	$3614	SMC, Ph: 02 9929 9150	Managed, Accton chip set	13	130	Aug-98

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SOFTWARE.

IMAGE EDITING SOFTWARE

	PRICE	VENDOR/DISTRIBUTOR	THE SPECS	RE-EDITABLE BRUSHSTROKES	LAYERS	REVIEWED
E Adobe Photoshop 5.0	$1495	Adobe Systems, Ph: 1800 065 628	114 effects, History palette for multiple undo	No	Yes	Nov-98
Corel Photo-Paint 8	$636	Corel, Ph: 1800 658 850	More than 70 effects, multiple undo	No	No	Nov-98
Painter 5	$629	Scholastic, Ph: 02 4328 3555	36 effects, vector-based text	No	No	Nov-98
Picture Publisher 8	$205	Micrografx, Ph: 1800 644 298	127 effects, most affordable	No	No	Nov-98
Wright Design 2.0	$995	Wright Technologies, Ph: 02 9690 2100	More than 100 effects, built on Windows NT	Yes	No	Nov-98

ILLUSTRATION SOFTWARE

	PRICE	VENDOR/DISTRIBUTOR	THE SPECS	MODEL WIZARDS	CONTEXT HELP	REVIEWED
Infini-D 4.5	$1299	Scholastic, Ph: 02 4328 3555	Excellent scene composition	No	No	Jan-99
Inspire 3D 1.0	$899	New Magic, Ph: 03 9532 9566	Excellent animation	No	No	Jan-99
E RayDream Studio 5.0	$659	Scholastic, Ph: 02 4328 3555	Excellent ease of use	Yes	Yes	Jan-99
SoftF/X Pro 4.1	$750	Lako Vision, Ph: 03 9852 7444	Good scene composition and animation	Yes	Yes	Jan-99

3D SOFTWARE

	PRICE	VENDOR/DISTRIBUTOR	THE SPECS	MACRO RECORDER	HIDE OBJECTS	REVIEWED
Adobe Illustrator	$895	Adobe Systems, Ph: 1800 065 628	Gradient mesh tool, multiple shape blends	Yes	No	Nov-98
Canvas 5.0.3	$799	Pca Software, Ph: 03 9388 9588	Can also create Web sites from documents	No	No	Nov-98
E CorelDraw8	$795	Corel, Ph: 1800 658 850	Object manager, can apply 2D/3D effects to bitmaps	Yes	No	Nov-98
Freehand 8	$679	Firmware Design, Ph: 1800 060 357	493 fonts, 10,000 clipart objects, 370 project templates	No	Yes	Nov-98

WEB GRAPHICS SOFTWARE

	PRICE	VENDOR/DISTRIBUTOR	THE SPECS	MULTIPLE UNDOS	PRODUCT TYPE	REVIEWED
Adobe ImageReady 1.0	$349	Adobe Systems, Ph: 1800 658 850	Excellent optimisation and automation	Yes	Standalone	Jan-99
CorelXara 2.0	$229	Corel, Ph: 1800 658 850	Excellent editing and illustration	Yes	Standalone	Jan-99
DeBabelizer Pro 4.5	$779	Firmware Design, Ph: 02 4721 7211	Excellent automation	Yes	Standalone	Jan-99
GIF Wizard	N/A	Raspberry Hill, www.gifwizard.com	Excellent automation	N/A	Online	Jan-99
E Macromedia Fireworks	$575	Firmware Design, Ph: 02 4721 7211	Excellent HTML and image editing	Yes	Standalone	Jan-99
NetGraphics Studio2	$70	Marketing Results, Ph: 02 9899 5888	Fair optimisation	Yes	Standalone	Jan-99
Ulead WebRazor 1.01	$99	Innovision, Ph: 1300 785 795	Good automation and optimisation	N/A	Plug-in	Jan-99

SPEECH RECOGNITION SOFTWARE

	PRICE	VENDOR/DISTRIBUTOR	THE SPECS	MODELESS OPERATION	DICTATION PB	REVIEWED
E Dragon NaturallySpeaking	$369	Auscript, Ph: 02 9238 6569	Average word recognition accuracy: 91%	Yes	Yes	Dec-98
IBM ViaVoice 98 Executive	$325	IBM, Ph: 13 24 26	Average word recognition accuracy: 85%	Yes	Yes	Dec-98
L&H Voice Xpress Plus	$299	Auscript, Ph: 02 9238 6569	Average word recognition accuracy: 87%	Yes	No	Dec-98
Philips FreeSpeech98	$79	Philips Speech Processing, Ph: 02 9704 8452	Average word recognition accuracy: 80%	No	Yes	Dec-98

SEARCH INDEXES AND DIRECTORIES

	PRICE	VENDOR/DISTRIBUTOR	THE SPECS	PORTAL FEATURES	REVIEWED
Alta Vista	N/A	www.altavista.yellowpages.com.au	Local Australian site available	Yes	Jan-98
Anzwers	N/A	www.anzwers.com.au	Local Australian site only	Yes	Jan-98
Excite	N/A	au.excite.com	Local Australian site available	No	Jan-98
E Hotbot	N/A	www.hotbot.com		No	Jan-98
Infoseek	N/A	www.infoseek.com		No	Jan-98
LookSmart	N/A	www.looksmart.com.au	Local Australian site available	Yes	Jan-98
Lycos	N/A	www.lycos.com		No	Jan-98
Northern Light	N/A	www.nlsearch.com		No	Jan-98
Open Text Index	N/A	www.opentext.net		No	Jan-98
PlanetSearch	N/A	www.planetsearch.com		No	Jan-98
Search.com	N/A	www.search.com		No	Jan-98
WebCrawler	N/A	www.webcrawler.com		No	Jan-98
WebWombat	N/A	www.webwombat.com.au	Local Australian site only	No	Jan-98
E Yahoo!	N/A	www.yahoo.com.au	Local Australian site available	No	Jan-98

OCR SOFTWARE

	PRICE	VENDOR/DISTRIBUTOR	THE SPECS	WORD ACCURACY	AVG SEC/PAGE	REVIEWED
Caere OmniPage Pro 8.0	$899	Performance Sales, Ph: 02 9450 0777	Requires 16MB RAM, 33MB disk space	97.6%	19.2	Mar-98
Presto! OCR Pro 3.0	$199	Impex Trading, Fax: 0011 64 9420 7466	Requires 8MB RAM, 25MB disk space	98.7%	23.5	Mar-98

Recognita	$986	Digital Colour Publishing, Ph: 07 3344 7244	Requires 8MB RAM, 15MB disk space	97.2%	13.0	Mar-98
E TextBridge Pro 98	$200	Fuji Xerox, Ph: 13 14 11	Requires 16MB RAM, 25MB disk space	98.8%	20.6	Mar-98
TypeReader Professional 4.0 Workstation	$685	Prosecan, Ph: 02 9904 1244	Requires 8MB RAM, 20MB disk space	98.1%	7.9	Mar-98

Remote Control Software

	Price	Vendor/Distributor	The Specs	Total Time for Transfers Modem-to-Modem	Dial-up	Reviewed
Carbon Copy 32 5.0	$199	Compaq, Ph: 1800 368 369	Can restrict drive access	5:25	4:24	Nov-98
CoSession Remote 32 8.1	$129	Marketing Results, Ph: 02 9899 5888	Can restrict drive access	8:44	9:42	Nov-98
LapLink for Win NT/95 7.5	$199	Hot Key, Ph: 02 9922 5199	Multiple host connections	3:06	3:16	Nov-98
NetOp for Win 5.4	$399	CheckMark Technologies, Ph: 1800 504 025	Remote installation, multiple host connections	4:11	4:01	Nov-98
E pcAnywhere32 8.0	$269	Symantec Australia, Ph: 02 9850 1005	Remote installation, can restrict drive access	2:51	3:09	Nov-98
RapidRemote 1.51	$99.95	Quarterdeck, Ph: 1800 659 041	Restores transfers after interruptions	2:33	3:42	Nov-98
ReachOut Enterprise 8.0	$402	Express Data, Ph: 02 9427 9640	Restores transfers after interruptions	5:02	3:11	Nov-98
Remotely Possible 4.0	$179	Computer Associates International, Ph: 1800 023 386	Remote installation, multiple host connections	N/A	7:55	Nov-98

Troubleshooting Utilities

	Price	Vendor/Distributor	The Specs	Reviewed
CheckIt version 5	$80	Marketing Results, Ph: 02 9899 5888	Good reporting, good diagnostics	May-98
E First Aid 98	$70	Cybermedia, Ph: 1800 621 399	Good tune-up, excellent troubleshooting	May-98
Norton CrashGuard Deluxe	$79	Symantec, Ph: 02 9850 1000	Good troubleshooting	May-98
Norton Utilities 3.0	$129	Symantec, Ph: 02 9850 1000	Excellent tune-up, good troubleshooting	May-98
E Nuts & Bolts	$100	Network Associates, Ph: 02 9437 5858	Excellent tune-up, good troubleshooting	May-98
PC Care 97	$89	Techstar, Ph: 07 3367 1444	Poor reporting, excellent diagnostics	May-98
RealHelp Extra Strength	$100	Quarterdeck, Ph: 02 9545 4072	Good tune-up, good troubleshooting	May-98

Uninstallers

	Price	Vendor/Distributor	The Specs	Avg. Seconds Before Install	Reviewed
E CleanSweep Deluxe	$90	Quarterdeck, Ph: 02 9545 4072	Prompts to remove backup files, browser-related files	2.7	May-98
Norton Uninstall Deluxe	$59	Symantec, Ph: 02 9850 1000	Creates self-installing files, removes browser-related files	15.4	May-98
Remove-It	$60	Quarterdeck, Ph: 02 9545 4072	Prompts to remove backup files, fully edits INI files	9.9	May-98
Uninstaller 4.5	$70	Cybermedia, Ph: 1800 621 399	Removes browser-related files	47.7	May-98
WinDelete 97	$60	IMSI, Ph: 02 9319 7533	Fully edits INI files	<1.0	May-98

File Viewers

	Price	Vendor/Distributor	The Specs	Reviewed
AutoVue Professional	$935	CADApps, Ph: 03 9416 2520	Displays columns, browser plug-in	May-98
Drag and View	$50	Intech, Ph: 02 9540 2374	HTML hyperlinks are live	May-98
KeyView Pro 6.0	$42	Select Computer, Ph: 02 6241 5633	Converts word processor formats	May-98
E QuickView Plus 4.5	$99	Inso, Ph: 02 9499 4611	Displays columns, browser plug-in	May-98
TurboBrowser 98	$99	DP Computing, Ph: 08 8326 4364	Converts word processor formats	May-98

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Virus Software

	Price	Vendor/Distributor	The Specs	Executable Viruses Missed	Excel Macro Viruses Missed	Reviewed
Dr Solomon's Anti-Virus	$99	Network Associates, Ph: 02 9437 5566	Automated updates	16	4	May-98
IBM Anti-Virus	$69	IBM, Ph: 13 24 26	Schedules automatic scans	13	0	May-98
InocuLAN AntiVirus	$94	Express Data, Ph: 02 9598 9100	Makes backup of master boot record	3	1	May-98
McAfee VirusScan	$67	Network Associates, Ph: 02 9437 5866	Schedules automatic scans	2	1	May-98
Norton AntiVirus	$99	Symantec, Ph: 02 9850 1000	Makes backup of master boot record	10	2	May-98
PC-Cillin	$90	Marketing Results, Ph: 02 9899 5888	Makes backup of master boot record	2	2	May-98
Vet Premium Anti-Virus	$99	Cybec, Ph: 03 9825 5600	Makes backup of master boot record	14	1	May-98
Leprechaun Virus Buster	$80	Leprechaun Software, Ph: 07 3823 1300		20	3	May-98
ViruSweep	$70	Quarterdeck, Ph: 02 9545 4072	Makes backup of master boot record	5	2	May-98

Network Backup Software

	Price	Vendor/Distributor	The Specs	Backup (min:sec)	Restore (min:sec)	Reviewed
ARCserver 6.1 for Netware	$2633	Computer Associates, Ph: 02 9937 0500	Unattended backup/restore, backs up open files	33:16	3:12	May-98
ARCserver 6.1 for Win NT	$1942	Computer Associates, Ph: 02 9937 0500	Unattended backup/restore, backs up open files	35:36	3:46	May-98
Replica 3 for Netware	$3633	Dawn Technologies, Ph: 02 9417 3822	Unattended backup, backs up open files	25:12	10:25	May-98
Replica 3 for Windows NT	$3633	Dawn Technologies, Ph: 02 9417 3822	Unattended backup, backs up open files	29:26	10:12	May-98
E Seagate Backup Exec	$2050	Aeronaut Industries, Ph: 02 9436 1175	For Netware, unattended backup/restore	29:18	2:48	May-98
E Seagate Backup Exec	$2050	Aeronaut Industries, Ph: 02 9436 1175	For Windows NT, unattended backup/restore	32:13	3:02	May-98

Java Development Packages

	Price	Vendor/Distributor	The Specs	Output File Size of a Sample Java App	Reviewed
CodeWarrior Professional 2.0	$699	Techflow, Ph: 1800 021 100	Provides classes for database connectivity	35,152	Jun-98
JBuilder Client/Server Suite	$2599	Inprise, Ph: 02 9248 0900	Provides classes for database connectivity, class browser	41,689	Jun-98
Sun Java Workshop 2.0	$230	Sun Microsystems, Ph: 02 9844 5000	Remappable keys/macros	40,403	Jun-98
Sybase PowerJ Enterprise	$3295	Sybase, Ph: 02 9936 8800	Supports ActiveX	34,477	Jun-98
VisualAge for Java 1.0	$4145	IBM, Ph: 13 24 26	Visual class designer tool	34,501	Jun-98
Visual Café 2.1	$699	Symantec, Ph: 02 9850 1000	Remappable keys/macros	41,689	Jun-98

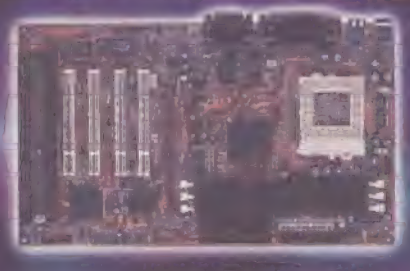
Project Management Software

	Price	Vendor/Distributor	The Specs	Open/Save Large File	Consolidate Mult. Projects	Reviewed
CA SuperProject 4.0	$995	Microtrannel, Ph: 02 9906 3686	64,000 tasks per project, 16,000 projects	3.2	10.8	Aug-98
E Microsoft Project 98	$779	Microsoft, Ph: 02 9870 2200	Unlimited tasks per project, 1000 projects	15.7	47.2	Aug-98
Project Scheduler 7	$1095	Bowten, Ph: 02 4822 4708	99,999 tasks per project, unlimited projects	6.7	7.4	Aug-98
SureTrak Project Manager	$795	P3 Software, Ph: 03 9888 4433	10,000 tasks per project, 1000 projects	40.0	63.3	Aug-98
Time Line 6.5	$790	Connect Direct, Ph: 02 6643 3215	32,000 tasks per project, unlimited projects	30.4	89.1	Aug-98
TurboProject Professional 2.0	$600	IMSI, Ph: 02 9319 7533	Unlimited tasks per project, unlimited projects	2.8	9.7	Aug-98

NO.1 SOCKET 370 MOTHERBOARD

TI7NBA

TI7NBA received the highest average rating from the Socket 370 Motherboard Review made by PC Magazine (ROC) January 1999 among 23 motherboards evaluated and garnered the best score under FPU Winmark, Business Graphics Winmark 99 , and Hi-End Graphics Winmark 99 benchmark tests.



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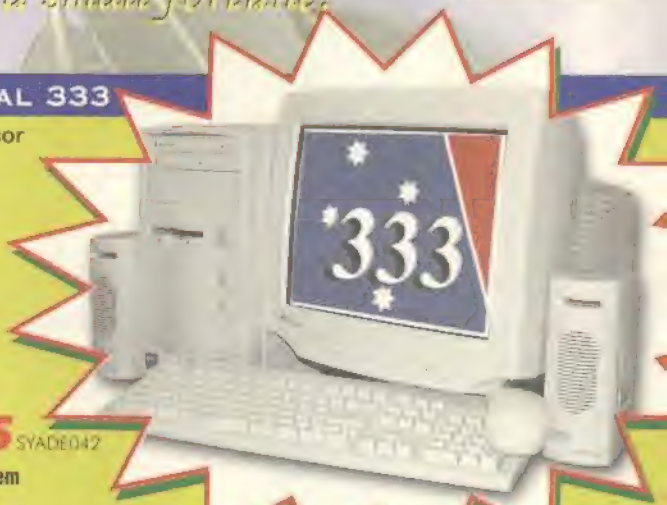

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IOMS1005	MICROSOFT INTELLI MS- RETAIL	95.00
IOMST009	MS WHEEL MOUSE 1.0	39.00
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PSAPC008	APC BACK-UPS 500VA	285.00
PSAPC009	APC BACK-UPS 650VA	380.00
PSAPC010	APC SMART-UPS 420VA	509.00
PSAPC011	APC SMART-UPS 650VA	650.00
PSAPC003	APC SMART-UPS 700VA	845.00
PSAPC004	APC SMART-UPS 1000VA	1275.00
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CAADE013	ADE DELUXE SERVER CASE	975.00
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CAADE008	CDROM EXT. CASE PARA	130.00

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Code	Model	Price	Code	Model	Price
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NBIBM005	IBM Thinkpad 390Z	**$3299**			

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- Windows 98

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- 32x CD-ROM
- Infinity Speakers
- 104KB & Mouse
- 56K Fax/Modem
- Windows 98

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- 15" Colour Monitor
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- Windows 98

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Pentium II 400Mhz
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Pentium II 450Mhz
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Pentium III 450Mhz
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Pentium III 500Mhz
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- 40X CD-ROM Drive
- Diamond Impact S90 SoundCard
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- ATX Case
- Wheel Mouse
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The AMD-K6®-III processor with 3DNow!(TM) technology is the ultimate sixth-generation processor for home PC enthusiasts and business power users. The key to this enhanced performance is our innovative TriLevel Cache design, which provides the largest total system cache for desktop PCs-more than four times the size of other competing system designs.

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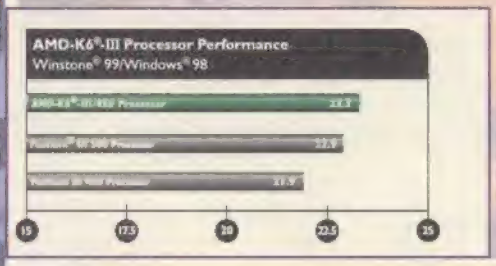

AMD-K6-III/450 processor-based PC is the highest performance solutions for home computing; beats Pentium III 500 based PC.

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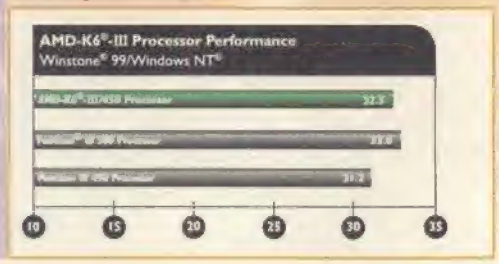
The AMD-K6-III processor outperforms an equally clocked Pentium III and delivers superior processing power for productivity applications in the Windows NT® environment. Business power users get all the computational muscle they need to manage web sites, zip through spreadsheets and word documents, and create high-impact presentations. If there's serious work to be done, PCs powered by AMD-K6-III processors are right for the job.



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Processor

Code	Model	Price
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CPINT022	Celeron 366Mhz with 128K Cache	$245
CPINT025	Celeron 400Mhz with 128K Cache	$345
CPINT023	Celeron 333Mhz PPGA	$170
CPINT024	Celeron 366Mhz PPGA	$225
CPINT026	Celeron 400Mhz PPGA	$325
CPINT029	Celeron 433Mhz PPGA	$410
CPINT015	Pentium II 350Mhz with 512K Cache	$415
CPINT016	Pentium II 400Mhz with 512K Cache	$660
CPINT017	Pentium II 450Mhz with 512K Cache	$1075
CPINT027	Intel Pentium III 450Mhz	$1175
CPINT028	Intel Pentium III 500Mhz	$1625

NEW

PPGA CPUs are compatible with socket 370 mainboards

AMD K6 2 PROCESSOR 3DNOW!

NEW

Code	Model	Price
CPAMD015	AMD K6-2 333	$179
CPAMD010	AMD K6-2 350	$245
CPAMD014	AMD K6-2 400	$365
CPAMD016	AMD K6-3 450	$649
CPAMD017	AMD K6-3 500	$1075

Heatsink and Fan

Code	Model	Price
MSADE006	Socket 7 CPU FAN	$15

K6 III Processor are compatible with the Gigabyte GA-5AX Mainboard See page 11

Cyrix MII Cyrix

Code	Model	Price
CPIBM008	M2-300MHZ	$99
CPIBM009	M2-333MHZ	$149

Heatsink and Fan

Code	Model	Price
MSADE006	Socket 7 CPU FAN	$15

Memory

SDRAM - For use in current Pentium / Pentium II systems utilising Intel TX / LX / BX Chipsets. PC-100 for 100Mhz Chipsets. Use individually. All SDRAM is 168 Pin.

*** For use with Intel BX & Super Socket 7 Mainboards**

Code	Model	Price
RAGEN008	32MB SDRAM	$88
RAGEN009	64MB SDRAM	$185
RAGEN021	128MB SDRAM	$379
RAGEN022	64MB PC-100 SDRAM	$195
RAGEN023	128MB PC-100 SDRAM	$365

EDO RAM - For use in newer 486 systems and most Pentium / Pentium Pro style systems. Used in pairs in Pentiums & Pentium Pro's.

Code	Model	Price
RAGEN005	16MB EDO SIMM 72 Pin	$69
RAGEN006	32MB EDO SIMM 72 Pin	$135

Fast Page RAM - For use in older 486 & Pentium systems and some printers.Use in pairs in Pentiums.

Code	Model	Price
RAGEN001	8MB SIMM 72 Pin	$45
RAGEN002	16MB SIMM 72 Pin	$75
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- Windows 98 operating system

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- 12.1" TFT Active Matrix Colour Display
- Built-in diskette drive
- 24X max. speed CD-ROM
- 4Gb hard disk drive
- 32MB high performance Synchronous DRAM, expandable to 160MB
- Windows® 98

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- 4Gb hard disk drive
- Optional Port Replicator
- 13.3" 1024 x 768 TFT active matrix colour display
- 64MB high performance Synchronous DRAM, expandable to 192MB
- Windows® 98

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SATELLITE 4060XCDT

- Intel® Pentium II® processor, 333MHz
- Integrated design with built-in diskette drive
- 24X max. speed CD-ROM
- 4Gb hard disk drive
- Optional Port Replicator
- 14.1" 1024 x 768 TFT active matrix colour display
- 64MB high performance Synchronous DRAM, expandable to 192MB
- Windows® 98

$5,225 NBTOS048

SATELLITE 4080XCDT

- Intel® Mobile Pentium® II processor, 366MHz
- Integrated design with built-in diskette drive
- 24X max. speed CD-ROM
- 6.4Gb hard disk drive
- Optional Port Replicator
- 14.1" 1024 x 768 TFT active matrix colour display
- 64MB high performance Synchronous DRAM, expandable to 192MB
- Windows® 98

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The Satellite 2520CDT provides exceptional value without compromising performance or reliability. Superb storage, plenty of expansion options and a dynamic sound system make the Toshiba Satellite 2520CDT a portable computer perfect for today's business and individual users. Using the AMD K6-II to obtain performance similar to Pentium II at a lower cost, this notebook is great for no affordable computing.

SATELLITE 2520CDT

- AMD K6- II 300MHz processor
- 12.1" TFT Active Matrix Colour Display
- Built-in diskette drive
- 24X max. speed CD-ROM
- 4Gb hard disk drive
- 64MB high performance Synchronous DRAM, expandable to 160MB
- Windows® 98 operating system

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- Integrated design with built-in diskette drive
- 24X max. speed CD-ROM
- 6.4Gb hard disk drive
- Optional Port Replicator
- 13.3" 1024 x 768 TFT active matrix colour display
- 64MB high performance Synchronous DRAM, expandable to 192MB
- Windows® 98

$6,599 NBTOS051

TECRA 8000 PII 366

- Intel® Mobile Pentium® II processor, 366MHz
- Integrated design with built-in diskette drive
- 24X max. speed CD-ROM
- 10Gb hard disk drive
- Optional Port Replicator
- 13.3" 1024 x 768 TFT active matrix colour display
- 64MB high performance Synchronous DRAM, expandable to 192MB
- Windows® 98

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- Windows 95
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NBCOM003

Convenience Base Docking Station

$299 NBCOM012

ACCESSORIES

- Lithium Ion Battery

$315 NBCOM013

- 32Mb Upgrade Memory

$225 NBCOM014

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Features include lighting fast graphics, portable multimedia performance with CD-ROM or DVD, great sounding audio and internet access.

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- 64MB RAM
- 4GB EIDE HDD
- 24X CD-ROM
- 2MB 3D 128-bit Accelerated Graphics
- 12.1" Active Color Screen
- JBL Pro Audio System
- MPEG-1 Full Motion Playback
- 56K V.90 Fax/Modem
- Windows 98
- 1 Year Warranty

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NBCOM010

SOFTWARE BUNDLE INCLUDES:
Microsoft Works, Word 97, Quicken Basic, Mcafee AntiVirus, Encarta 99

- Intel Pentium II 300Mhz
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- 4GB EIDE HDD
- 2X DVD-ROM Drive
- 2.5MB 3D 128-bit Accelerated Graphics
- AGP for Advanced Graphics
- 13.3" Active Color Screen
- JBL Pro Audio System
- 56K V.90 Fax/Modem
- Windows 98
- 1 Year Warranty

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NBCOM011

COMPAQ ARMADA 1750

All in one design combining the latest key technologies for outstanding convenience

- Mobile Pentium II 300MMX
- 64MB SDRAM (192MB MAX)
- 4GB EIDE HDD
- 24X CD-ROM
- 2MB SGRAM 64-bit Graphics
- 13.3" Active Color Screen
- 56K Fax/Modem
- 2.5Hr Battery Life
- Windows 95
- 1 Year International Warranty

$5,395

NBCOM005

- Mobile Pentium II 333MMX
- 64MB SDRAM (192MB MAX)
- 6.4GB EIDE HDD
- 24X CD-ROM
- 4MB SGRAM 64-bit Graphics
- 13.3" Active Color Screen
- 56K Fax/Modem
- 2.5Hr Battery Life
- Windows 95
- 1 Year International Warranty

$5,995

NBCOM006

Mobile Pentium III 366MMX
64MB SDRAM
6.4GB HDD
14.1" TFT Screen

$6,845

NBCOM007

COMPAQ ARMADA 7400

The Armada 7400 is ideal for the mobile users who demand outstanding system performance and portability with desktop equivalent capabilities. Weighing in at only 2.8kg and a super slim 41mm the Armada 7400 is packaged in a durable alloy case

- Mobile Pentium II 300MMX
- 64MB SDRAM (256MB MAX)
- 4GB EIDE HDD
- 24X CD-ROM
- 2MB SGRAM 64-bit AGP Graphics
- 13.3" Active Color Screen
- 2.6Hr Battery Life
- Windows 95
- 3 Year International Warranty

$6,095

NBCOM008

- Mobile Pentium II 333MMX
- 64MB SDRAM (256MB MAX)
- 6.4GB EIDE HDD
- 24X CD-ROM
- 4MB SGRAM 64-bit AGP Graphics
- 13.3" Active Color Screen
- 2.6Hr Battery Life
- 56K Fax/Modem
- Windows 95
- 3 Year International Warranty

$7,125

NBCOM009

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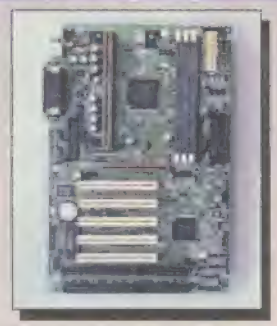
AOpen Mainboards

AOpen AX6BC Mainboard



Introducing the AOpen AX6BC Mainboard featuring the Intel BX Chipset. A unique jumperless design, CPU monitoring & protection circuitry combines ease of use with reliability and performance. Winner of many international awards you can be sure that the AX6BC Mainboard will work with you, not against you.

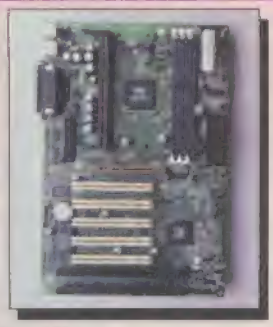
- ***Supports Intel Pentium II 233 - 450Mhz, Pentium III & Celeron Processors,***
- ***5 x PCI, 2 x ISA, 1 x AGPx2 Expansion slots***
- ***768MB SDRAM for 3 x DIMM slots***
- ***2 x Serial, 1 x Parallel, 2 x USB Ports***
- ***2 x EIDE Controller & ATX Form Factor***
- ***Supports Wake on LAN, DMI, SB-LINK***

Pentium III Ready

$229

MBACE000

AOpen AX63 Pentium II Mainboard



The AOpen AX63 Mainboard brings true computing performance at a very affordable price. Powered by the advanced VIA Apollo Pro Plus AGP chipset the AX63 Mainboard supports technologies such as Jumperless design, Resetable fuse for USB & K/B, BIOS flash protection and CPU protection.

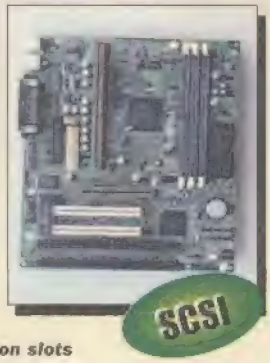
- ***Supports Intel Pentium II 233 - 450Mhz, Pentium III & Celeron Processors***
- ***5 x PCI, 2 x ISA, 1 x AGPx2 Expansion slots***
- ***768MB SDRAM for 3 x DIMM slots***
- ***2 x Serial, 1 x Parallel, 2 x USB Ports***
- ***2 x EIDE Controller & ATX Form Factor3***

Pentium III Ready

$195

MBACE002

AOpen AX6B Plus Mainboard



Building on the quality & performance of the AX6BC Mainboard the new Aopen AX6B comes standard with an Adaptec 7880P Ultra Wide SCSI Controller (onboard). An excellent choice for mid range servers and workstations where speed is a must!

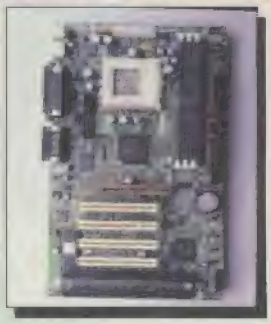
- ***Supports Intel Pentium II 233 - 450Mhz, Pentium III & Celeron Processors***
- ***4 x PCI, 3 x ISA, 1 x AGPx2 Expansion slots***
- ***768MB SDRAM for 3 x DIMM slots***
- ***2 x Serial, 1 x Parallel, 2 x USB Ports***
- ***SCSI on board - Adaptec 7880P SCSI Controller With 68pin U/W & 50pin Ultra SCSI connectors***
- ***2 x EIDE Controller & ATX Form Factor***
- ***Supports Wake on LAN, DMI, SB-LINK***

Pentium III Ready

$495

MBACE001

AOpen AX3L Celeron Mainboard



The AOpen AX3L supports the latest generation of Intel Celeron socket 370 (PPGA) Processors. Featuring an ESS Solo 1 PCI Soundcard the AX3L Mainboard provides an excellent computing platform on which to build.

- ***Supports Intel Celeron 300A - 400Mhz***
- ***4 x PCI, 2 x ISA, 1 x AGPx2 Expansion slots***
- ***384MB SDRAM for 3 x DIMM slots***
- ***2 x Serial, 1 x Parallel, 2 x USB Ports***
- ***2 x EIDE Controller & ATX Form Factor***

BONUS Norton AntiVirus With All AOpen Mainboards

$195

MBACE000

AOpen EIDE CD-ROM

BONUS Norton AntiVirus

- ATAPI IDE CD-ROM
- Ultra DMA Supported
- 512Kbytes buffer
- Compatible with CD-DA, CD-ROM/XA, CD-I/MPEG, Photo CD, Karaoke CD, CD, CD-RW, Packet write
- Audio Extraction

AOpen CD-948E

MAX Transfer Rate 7200KB/sec with 48X

48X CD-ROM

$129

MMACE001

AOpen CD-940E

MAX Transfer Rate 6000KB/sec with 40X

40X CD-ROM

$99

MMACE000

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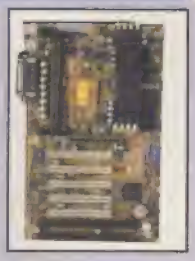
Mainboards

GIGABYTE

Dual BIOS Gigabyte Technology is pleased to introduce DualBIOS, a "hot spare" for your system bios. In the event that your primary BIOS fails the second BIOS backs you up almost automatically. A feature found in the GA-BX2000, GA-6GXU & GA-6GXDW boards.

GA-BX2000

- Intel BX Chipset
- Support Intel Pentium II/III & Celeron Processors
- Slot 1 with AGP slot
- Supports 66/75/83/100/112/133Mhz System BUS
- Clock Multiplier 3.0 - 6.5X
- 4 DIMM sockets to 1GB DRAM
- 5 x PCI, 1x AGP, 2 x ISA Expansion slots
- ATX Form Factor with USB
- Includes DualBIOS technology

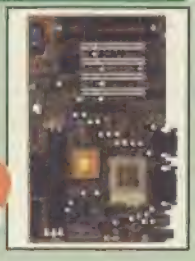


$Call MBGIG024

GA-5AX

- ALI - Aladdin V AGPset
- Support AMD K6 III Processor, Intel Pentium MMX
- Socket 7 Processors from
- Supports 66/75/83/95/100/115/120Mhz System BUS
- 512KB Cache onboard
- 3 DIMM sockets to 768MB DRAM
- 5 x PCI, 1x AGP, 2 x ISA Expansion slots
- ATX Form Factor with USB

Support AMD K6-III

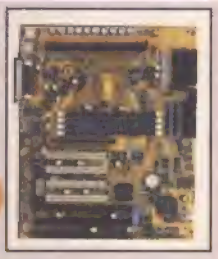


$165 MBGIG025

GA-6GXU

- Intel GX Chipset, Slot 2
- Supports Intel XEON processors
- Supports 100/112/124/133Mhz System BUS
- Adaptec 7890 Ultra 2 SCSI onboard
- 4 DIMM sockets to 2GB DRAM
- 4 x PCI, 1x AGP, 3 x ISA Expansion slots
- Includes DualBIOS technology

SCSI

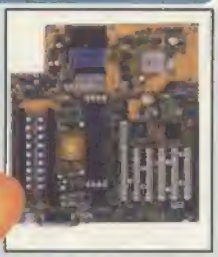


$Call MBGIG026

GA-6GXDW

- Intel GX Chipset, Slot 2
- Supports DUAL Intel XEON processors
- Supports 100/112/124/133Mhz System BUS
- Adaptec 7890 Dual Channel Ultra 2 SCSI onboard
- 4 DIMM sockets to 2GB DRAM
- 6 x PCI, 1x AGP, 1 x ISA Expansion slots
- Includes DualBIOS technology

Dual SCSI



$Call MBGIG027

SCSI Cards

adaptec

ADAPTEC 2906 PCI

Connect up to 7 SCSI devices and gain great performance by moving to SCSI with the Adaptec 2906.

$115

ADAPTEC SLIMSCSI 1460

Connect SCSI devices to your laptop
For attaching a wide range of SCSI devices such as drives, CDROMs, peripherals and scanners to your notebook computer look no further than the Adaptec 1460 SlimSCSI card. Designed for Windows 95/98 and includes DB25 and Honda50 connections.

$295 CCGEN011

ADAPTEC 2940 UW PCI CARD

The Adaptec AHA-2940 Ultra Wide host adapter is the ideal SCSI adapter for entry level servers and workstations. It connects up to 15 devices and moves data at up to 40Mb/s.

OEM **$395** CCGEN005

RETAIL KIT **$625** CCGEN006

ADAPTEC 2940U2W

Unleash the full potential of your server or workstation
When it comes to boosting the performance of servers and workstations to 80Mb/s utilising Ultra2 SCSI (LVD) technology. By combining the Adaptec 2940U2W with high-performance disk drives like Seagate's Cheetah & Barracuda for the ultimate performance.

RETAIL KIT **$725** CCGEN018

OEM **$545** CCGEN052

ADAPTEC AAA131

High end applications demand high-performance computing. The AAA-131 array adapter caches, reads and writes while intelligently stripping data on two or more drives for maximum I/O subsystem performance.

RAID

AAA-131 Single Channel	AAA-131 Single Channel 16Mb Cache	AAA-133 3 Channel 120Mb
$909 CCGEN025	**$1099** CCGEN009	**$1449** CCGEN010

SCSI CABLES CABLES

CB-GEN042	1M CENT50M TO CENT50M SCSI	$15
CB-GEN043	1.8M CENT 50M CENT 50M SCSI	$17
CB-GEN044	1M CENT 50M/DB25M SCSI	$15
CB-GEN047	1M HONDA 50M/CENT 50M	$25
CB-GEN048	1.8M HONDA50M/CENT50M	$29
CB-GEN049	1M HONDA 50M/DB25 SCSI II	$25
CB-GEN050	1M HONDA 50M/HONDA 50M	$39
CB-GEN051	1M HONDA 68M/HONDA 68M	$45
CB-GEN052	1M HONDA 68M/HON 50M	$45
CB-GEN053	1M HOND A 68M/CENT 50M	$45
CB-GEN083	HONDA 68 TO DB25 M SCSI III	$45
CB-GEN057	INTERNAL SCSI III	$85
CB-GEN060	INT SCSI CABLE 7 CONNECT	$15

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Hard Drives

High performance disk solutions from Seagate catering for: Seagate

- High end multimedia & video applications (A/V)
- High performance workstations, servers and super computers
- Graphics and 3D Applications
- Internet/Intranet based webservers

Seagate Medalist Pro

Cost effective, high performance SCSI hard drives with 512K cache and a spindle speed of 7200RPM.

Code	Model	Capacity	Interface	Tr/Rate	Price
HDSGT025	ST36530N	6.4GB	Ultra SCSI	20Mbps	$585
HDSGT026	ST36530W	6.4GB	Ultra Wide SCSI	40Mbps	$585

Seagate Barracuda

High Capacity, ultra high performance SCSI Hard Drives with a seek time of 7ms and a spindle speed of 7200RPM.

Code	Model	Capacity	Interface	Tr/Rate	Price
HDSGT014	ST39173W	9.1GB	Ultra Wide SCSI	40Mbps	$895
HDSGT027	ST39173LC	9.1GB	LVD 80 Pin	80Mbps	$895
HDSGT028	ST39173LW	9.1GB	LVD 68 Pin	80Mbps	$895
HDSGT036	ST39173FC	9.1GB	Fibre Channel	100Mbps	$895
HDSGT023	ST118273W	18GB	Ultra Wide SCSI	40Mbps	$1595
HDSGT029	ST118273LC	18GB	LVD 80 Pin	80Mbps	$1595
HDSGT030	ST118273LW	18GB	LVD 68 Pin	80Mbps	$1595
HDSGT037	ST118273FC	18GB	Fibre Channel	100Mbps	$1595

Seagate Cheetah

Ultimate Performance for servers and high-powered workstations. Features an industry leading 10,000 RPM spindle speed & a cache buffer of 512K.

Code	Model	Capacity	Interface	Tr/Rate	Price
HDSGT031	ST39102LC	9.1GB	LVD 80 Pin	80Mbps	$1275
HDSGT032	ST39102LW	9.1GB	LVD 68 Pin	80Mbps	$1275
HDSGT035	ST39102FC	9.1GB	Fibre Channel	100Mbps	$1275
HDSGT033	ST118202LC	18GB	LVD 80 Pin	80Mbps	$2175
HDSGT034	ST118202LW	18GB	LVD 68 Pin	80Mbps	$2175
HDSGT038	ST118202FC	18GB	Fibre Channel	100Mbps	$2175

LVD Low Voltage Differential Drives are for use with Ultra 2 SCSI Controllers such as the Adaptec 2940U2W Controller giving you a transfer rate of 80Mbps. Backwards compatible with Ultra & Ultra Wide SCSI Controllers.

IBM Hard Drives

IBM

TravelStar 2.5" IDE Drives

Experience blistering performance on a notebook computer. The IBM range of TravelStar IDE drives feature 512K of cache accessed via an Ultra ATA interface. Compatible with all notebook & laptop computers.

LAPTOP DRIVES

Code	Capacity	Seek Time	Tr/Rate	Price
HDIBM002	3.2GB	13ms	33Mb/s	$355
HDIBM025	4.8GB	12ms	33Mb/s	$425
HDIBM026	5.4GB	12ms	33Mb/s	$515
HDIBM027	6.4GB	12ms	33Mb/s	$565

UltraStar 3.5" SCSI Drives

Quality, performance at a reasonable price is what the IBM UltraStar range of hard drives offer. Featuring a seek time of 7.5ms, cache size of 512K and a spindle speed of 7200 RPM be sure that the UltraStar range of drives will give you sizzling performance that wont break the bank!

Code	Capacity	Interface	Tr/Rate	Price
HDIBM010	4.5GB	Ultra Wide SCSI	40Mb/s	$485
HDIBM012	9.1GB	Ultra Wide SCSI	40Mb/s	$775

Quantum Hard Drives

Quantum

The new Quantum Fireball EX EIDE hard disk drives reaffirms the Fireball brand as the standard in desktop storage. Quantum drives feature Shock Protection SystemTM (SPS) which prevents shock from having a detrimental effect on a drives long term reliability and data integrity.

Code	Capacity	Seek Time	Spindle Speed	Tr/Rate	Price
HDQTM041	3.2GB	9.5ms	5400 RPM	33Mb/s	$239
HDQTM039	6.4GB	9.5ms	5400 RPM	33Mb/s	$299
HDQTM038	12.7GB	9.5ms	5400 RPM	33Mb/s	$465

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Sydney NSW 2000
Ph: (02) 9267 5272
Fax: (02) 9267 5042

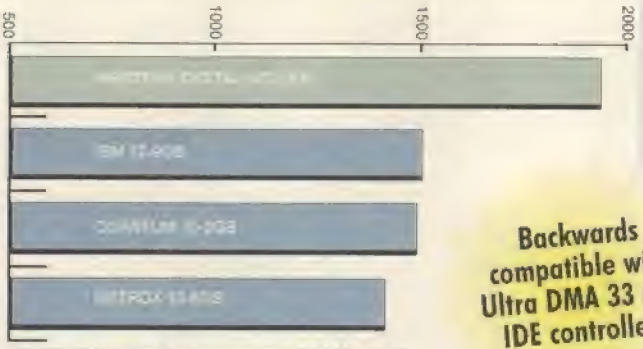
Hard Drives

Western Digital
WD Caviar®

Introducing the new range of Western Digital Caviar EIDE hard drives. Sporting the industry's first Ultra ATA/66 high speed data transfer feature, the new Caviar drives feature a maximum transfer rate of 66Mb/s. That's double the speed of its nearest rival.

All Western Digital Caviar drives undergo 200 rigorous tests before shipping to ensure compatibility and reliability with all your existing hardware & software applications.

Competition Performance Comparison



WINBENCH 98. Test Performance on a PII-300. Win 98

Backwards compatible with Ultra DMA 33 and IDE controllers

Data LifeguardTM is a system of embedded features designed to protect end-user data by automatically detecting, isolating and repairing problem areas on the hard drive before possible data loss can occur. Data Lifeguard is implemented in Western Digital's latest WD Caviar hard drives.

Ultra ATA/66 is the latest in hard drive technology providing a maximum transfer rate of 66Mb/s as compared to the industry standard of 33Mb/s. Backwards compatible with all existing IDE & EIDE ports the Western Digital Caviar drives will integrate smoothly in your PC or MAC G3.

Note: to take advantage of ATA66 you need a controllable HD controller & cable

- ULTRA ATA 66
- 66Mb/Sec Transfer Rate
- 512Kb Cache For Maximum Performance
- Low 9.5ms Access Speed
- 5400RPM

Code	Model	Size (GB)*	Transfer Rate	Price
HDWES002	AC14300	4.3GB	66Mb/s	**$265**
HDWES003	AC25400	6.4GB	66Mb/s	**$290**
HDWES004	AC28400	8.4GB	66Mb/s	**$335**
HDWES005	AC310200	10.2GB	66Mb/s	**$385**
HDWES006	AC313000	13.1GB	66Mb/s	**$485**
HDWES007	AC420400	20 GB	66Mb/s	**$690**

*1Gb = 1 Billion bytes

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Multimedia

DIAMOND

www.diamondmm.com.au

Sonic Impact S90

Hot 3D Wavetable Audio!

Diamond's Sonic Impact S90 uses advanced A3D technology to bring life-like positional 3D game play to your PC. Sonic Impact S90 includes hardware acceleration for 64 wavetable voices and Aureal's A3D to immerse you in the middle of the action. Add realistic atmospheric effects, including fog and underwater sounds, and you have total audio transformation for your PC.

- PCI design for faster system performance
- 64 Hardware wavetable voices
- Supports downloadable samples
- Runs with DOS, Win95/98, Win NT 4.0

PRICE DROP

MMDIA010 **$110** RETAIL

MMDIA008 **$59** OEM

Stealth III Series

Latest 3D Technology

The New Generation of Stealth is coming!! With up to a huge 16MB of graphics memory, and AGP 2X/4X power, Diamond's new Stealth III series will deliver cutting edge games and application performance at affordable prices.

Please Call To Ask About Availability And Price.

- Features up to 16MB of graphics memory
- Supports resolutions up to 1920 x 1440
- AGP 2X or 4X (depending on model)

Viper V550

The Viper V550 from Diamond features unprecedented 128-bit power for the state-of-the-art 2D graphics and stunning 3D quality for high-speed game play, business and professional graphics. Fully optimised for Windows 98, Viper V550 is the next generation in high performance graphics acceleration. Available in PCI and AGP 2X configurations.

- Featuring 16MB of SDRAM
- 128-bit dual processor architecture
- Accelerates OpenGL and DirectX
- Supports software DVD

16MB

PRICE DROP

DCDIA016 **$345** PCI

DCDIA018 **$329** AGP

DCDIA017 **$259** AGPOEM

Monster Sound MX300

Ultimate 3D Audio Experience!!!

Want to annihilate your opponents every time? Diamond's Monster Sound MX300 gives you awesome combat tools: Aureal's latest A3D 2.0 positional audio, 4-speaker support and 64-voice hardware wavetable synthesis. Imagine playing your favourite PC game hearing footsteps from behind you and gun shots from overhead. Monster Sound MX300 delivers unbelievable 3D effects to give you the unfair advantage.

- Hardware A3D 2.0 acceleration
- 9.6 audio systems
- Features Dolby Digital (AC-3) support
- Advanced 320-voice wavetable with support for downloadable samples
- Supports DOS and Windows games

MMDIA011 **$209** RETAIL

NEW MMDIA013 **$149** OEM

Rio PMP300

Internet Music in the Palm of Your Hand!

The first portable MP3 music player that stores up to 60 minutes of digital quality sound. Load the latest songs on to Rio directly from your Hard Drive, personal CD's or the Internet and carry them with you. It's smaller than an audio cassette and has no moving parts, so it never skips. Powered by a single AA battery, Rio provides up to 12 hours of continuous music playback.

- Lightweight - only 70 grams
- Palm size for easy portability
- 32MB built-in flash memory

MMDIA012 **$449**

16MB Flash Memory Card **$139** MMDIA014

Micronics C400

The Ultimate Multimedia Platform

Diamond's Micronics C400 motherboard is the perfect platform for your ultimate multimedia system. Featuring Intel's 440BX AGPset, it supports Pentium II and Celeron processor up to 450MHz. Ultra DMA/33, USB and IR communications. For your totally accelerated PC, start with the best!

- 5 PCI slots (1 shared)
- Award BIOS on 1MB flash
- Legendary Micronics quality and performance

$265

MMDIA000

HomeFree

Easy Wireless Networking!

No holes! No cables! HomeFree delivers 1MB wireless links for up to 16 PCs, 45 meters apart. Includes point-and-click network setup, software for shared Internet access, all at an incredible price. Windows 95/98 only.

- Frequency hopping for maximum security
- 45-metre range
- Each kit contains 2 nodes

Desktop to Desktop **$409** MMDIA000

Desktop to Notebook **$475** MMDIA001

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3DFX Voodoo 3

The Voodoo3 family of boards deliver the ultimate in 3D and 2D performance, while supporting the new generation of ultra-high resolution displays. They are designed for consumers and game enthusiasts seeking the most compelling entertainment experience available on a PC. No longer is a separate VGA card needed. The Voodoo 3 is a combined 128-bit 2D Accelerator and 3D graphics monster in one! D3D, Glide & OpenGL Support.

Voodoo 3 2000

- 16MB SDRAM
- 143Mhz Core Clock Speed
- 300Mhz RAMDAC
- Resolution up to2048 x 1536
- Hardware Assisted DVD
- AGPx2 or PCI

PCI $CALL DCMAG006

AGP $CALL DCMAG007

Voodoo 3 3000

- 16MB SDRAM AGPx2
- 166Mhz Core Clock Speed
- 350Mhz RAMDAC
- Resolution up to2048 x 1536
- Hardware Assisted DVD
- TV/S-Video Output
- 100 Billion operations per second

$CALL DCMAG008

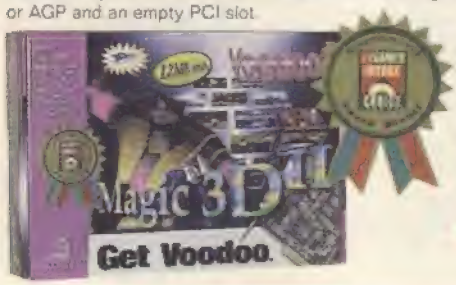
Voodoo 3 3500

- 16MB SGRAM AGPx2
- 183Mhz Core Clock Speed
- 350Mhz RAMDAC
- Resolution up to2048 x 1536
- Hardware Assisted DVD
- TV/S-Video Output
- Digital LCD support

$CALL DCMAG009

MAGIC 3D Voodoo2

The Magic 3D II utilizing the 3DFX Voodoo2 offers a totally mind-blowing 3D gaming experience. Play games at the fastest frame rates and colors - an experience just like the arcades. Requires an existing Graphics Card either PCI or AGP and an empty PCI slot.



- 12MB Memory 100Mhz DRAM
- Supports 3DFX Glide, Direct3D, OpenGL
- SLI Capable

$199 DCMAG000

MAGIC 3D Banshee

The Magic TwinPower incorporating the latest 3DFX Voodoo Banshee chipset is one of the fastest and most amazingly fast 2D/3D Graphics Accelerator on the market today. Play games at up to 60 fps and run high resolution games/ applications at up to 1600 x 1200 with hardware acceleration.

- 128-bit combined 2D/3D Voodoo Banshee chipset
- 16MB Memory with 125Mhz SGRAM
- Supports Glide, OpenGL, DirectX, Direct3D
- NT 4.0 & Windows 95/98 compatible

$185 PCI DCMAG001

$185 AGP DCMAG002

MAGIC TNT 2D/3D

The most versatile high-end graphics accelerator on the market today utilizing the nRIVA TNT Chipset. The awesome speed and color depth of the Magic TNT will amaze gamers, while multimedia users will love the high resolution (1920 x 1200 @32bit color) and super-fast redraw capabilities of the Magic TNT.

- 16MB 128-bit SDRAM
- 250Mhz RAMDAC
- Optimized Direct3D Acceleration & OpenGL support
- Software DVD support
- AGPx2

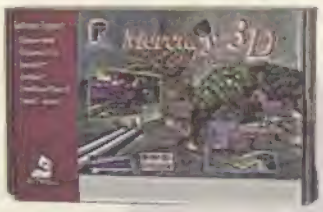
$225 DCMAG003

MAGIC Mercury 3D

The Mercury 3D is a graphics accelerator with the ability to deliver outstanding 2D and 3D performance to your desktop today at a price that's affordable. Software MPEG1 and MPEG2 (DVD) playback is a reality now as is 3D gaming with support for advanced features such as Gouraud shading and tri-linear filtering.

- Rendition V2200 Graphics Chipset
- 8MB 100Mhz SGRAM
- Open GL & Direct 3D support
- AGP interface

$75 DCMAG004



S3 Trio 3D AGP

For the ideal entry level 2D/3D graphics accelerator look no further than the S3 Trio3D. Featuring a 128-bit graphics engine and 230Mhz RAMDAC the Trio3D is able to support high quality video and games.

- 4MB 100Mhz SGRAM
- 1280 x 1024 x16Million Colors
- 1600 x 1200 x 64k colours
- Enhanced S3 stream Processor technology for hardware assisted video playback
- AGP

$55 DCMAG005

LifeView FlyVideo

Watch full screen TV on your PC with the FlyVideo TV Card. Capture live video & images from your VCR or Camcorder, or use a CCD Camera and video-conference over a LAN or Internet. Plug and Play installation makes configuration an ease whilst a handy remote control will give you a truly relaxing experience.

$129 DCMAG010

HOT

new

ALTEC LANSING

Speakers

ADA305 Digital PowerCube

The ADA305 Digital PowerCube delivers multidimensional audio excitement resulting from a Dolby Pro Logic decoder in the subwoofer. To deliver the multichannel audio, the Digital PowerCube uses Altec Lansing's patented side-firing speakers so that the audio is driven to the side and rear for a true multidimensional audio experience.

- 20 Watts RMS Satellite Speakers
- 2 x 3" full range drivers
- 6" Subwoofer
- USB ready
- Frequency Response 20Hz - 20Khz

DIGITAL PROLOGIC

$395

ADA70 Altec Lansing

USB allows multimedia audio to enter the digital domain so that you can experience real-life sound reproduction via your personal computer. The ADA70 is a 3 piece system with USB connection for the most realistic audio playback you can experience from your personal computer. Great for CDs and multimedia.

- ADA 70 Digital USB Speaker
- 3" Full Range Driver & 1" Dome Tweeter
- 14 Watt RMS Satellite Speakers
- 6.5" Dual Voice Coil Woofer
- 20 Watt RMS Subwoofer
- Frequency Response 35Hz

$295

ACS48 PowerCube Plus Speaker System

The PowerCube Speaker System, from Altec Lansing is the markets leading affordable audiophile multimedia audio solution for the home or office. Comprising of a 3 unit system, allows you to experience hi-fi quality audio from your CDs, games or the Internet. In addition, the Powercube Plus 6" subwoofer is encased in wood, offering you a deeper low frequency response.

- 20 Watts RMS Satellite Speakers
- 3" full range driver
- 3/4" high frequency driver
- 40 Watts RMS, 6" subwoofer
- frequency response 35Hz - 20 Khz

$285

ACS45 PowerCube Speaker

Introducing the Altec Lansing ACS45 PowerCube Speakers, a three piece multimedia audio solution at an unbelievable price. Experience the enhanced output of the PowerCube satellite system . Great for games and CD's, the ACS45 will bring hi-fi audio to your computer desktop today.

- 6 Watts RMS Satellite Speakers
- 3" full range driver
- 20 Watts RMS, 6" subwoofer
- frequency response 35Hz - 20 Khz

BEST Speaker under $200

$195

3dfx Graphic Cards

All Voodoo3 Cards Support

- 32 bit internal rendering
- full 128-bit 2D accelerator
- DVD hardware assist
- DirectX®, Glide® and OpenGL®

Voodoo3 3500 Quake II time demo benchmark
106fps at 800x600
84fps at 1024x768
35 fps at 1600x1200

AGP **$389**

Industry-Leading Performance
The 143MHz Voodoo3 2000 AGP and PCI boards are expected to generate up to 6 million triangles and 286 Megatexels per second at resolutions of up to 2,048 by 1,536 pixels. The Voodoo3 2000 boards will feature a 300MHz RAMDAC and 16MB of SDRAM.

PCI **$389**

The 166MHz Voodoo3 3000 AGP board is expected to generate 7 million triangles and 333 Megatexels per second at resolutions of up to 2,048 by 1,536 pixels Features a 350MHz RAMDAC, TV/S-Video Out capabilities as well as a game bundle featuring best-selling titles. The Voodoo3 3000 will also feature 16 MB of SDRAM

$489

$689

The 183MHz Voodoo3 3500 AGP board is expected to deliver up to 8 million triangles and 366 Megatexels per second at resolutions of up to 2,048 by 1,536 pixels. The Voodoo3 3500 will include 3Dfx's proprietary flat-panel support, LCDfx. Voodoo3 3500 features a 350MHz RAMDAC, TV/S-Video Out capabilities as well as a game bundle featuring best-selling titles. The Voodoo3 3500 will also feature 16 MB of SGRAM.

INTERNET WEB SITE:
http://www.adelong.com.au
e.mail: info@adelong.com.au

HEAD OFFICE & SERVICE
54 Rosebery Avenue
Rosebery NSW 2018
Ph: (02) 9344 3188
Fax: (02) 9697 9777

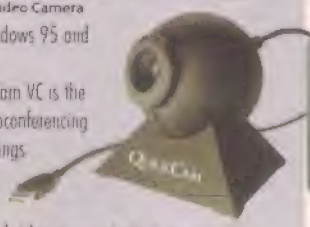
CITY OFFICE
127 York Street
Sydney NSW 2000
Ph: (02) 9267 5272
Fax: (02) 9267 5042

Video conference and send images or movies over the internet CD-Rom full of editing, capturing, and emailing pictures and videos included.

Logitech

Logitech QUICKCAM VC
PC Video Camera

- Works with Windows 95 and Window 98
Logitech QuickCam VC is the affordable videoconferencing solution that brings the excitement, and expressiveness of video communications to your desktop. • Capture still images and video clips in colour
- USB or parallel port versions



PARALLEL **$170** IOLOG013 USB **$170** IOLOG014

Logitech QUICKCAM HOME
PC Video Camera

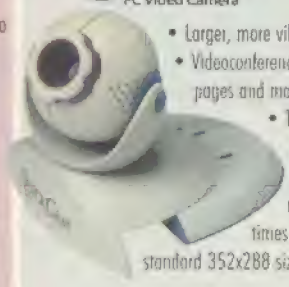
- Capture full-colour, video
- Build-in microphone for natural communication
- Plug & play USB
- 320x240 at 25fps capture
- 640x420 still image capture

Logitech QuickCam Home was designed with camcorder technology to deliver sharp still images, and enhance video quality at up to 30 frames per second.

$265 IOLOG015

Logitech QUICKCAM PRO
PC Video Camera

- Larger, more vibrant pictures
- Videoconferencing, video e-mail, web pages and more
- The Logitech QuickCam Pro captures image at a true 640 x 480 resolution. That's 3 times the resolution of standard 352x288 size cameras.



PARALLEL **$279** IOLOG016 USB **$279** IOLOG017

USB Wheel Mouse
AWARD-WINNING COMFORT FOR USB SYSTEMS

USB Wheel Mouse gives you the advantage of Logitech's unique wheel button in a comfortable mouse you can use with either hand. Use the wheel button as both a fully-functional mouse wheel for scrolling and zooming and a third, customizable, mouse button.In addition to scroll and zoom, MouseWare software makes it simple to customize USB Wheel Mouse buttons with one-click commands.

IOLOG018 **$79**

TRACKMAN MARBLE + THUMB-OPERATED
SCROLL AND ZOOM WITH MARBLE PERFORMANCE

NEVER USE SCROLL BARS AGAIN

With the scrolling wheel, you can scroll from wherever your cursor rests in any Windows 95/98, Windows NT 4.0, or Internet application without having to move over to the scroll bars. Award-winning MouseWare software makes it simple to personalize your performance by assigning one-click commands to the TrackMan Marble + buttons.

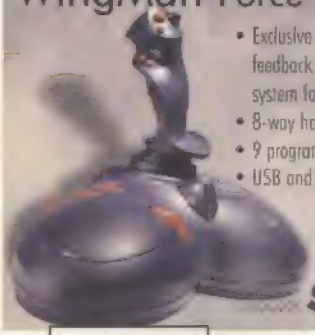
IOLOG019 **$120**

WingMan Joystick

- Award-winning handle design
- Throttle control
- Steel-weighted base
- Realistic rubber buttons

IOLOG018 **$55**

WingMan Force



- Exclusive I-FORCE feedback steel-cable drive system for greater relism
- 8-way hat switch
- 9 programmable buttons
- USB and serial interfaces

IOLOG019 **$225**

WingMan FormulaForce

- Exclusive I-FORCE feedback steel-cable drive technology
- Programmable European-style paddle shifters plus four buttons
- Gas and Brake pedals with realistic spring forces

IOLOG020 **$325**

INTERNET KEYBOARD
PC KEYBAORDS FOR FAST WEB NAVIGATION

IOLOG011 **$75**

The Logitech Internet keyboard puts all your favourite Web commands, applications, and sites right at your fingertips. This is a complete solution that provides all the functionality you want for entering text into your favourite applications, controlling your computer, and making the most of your on-line time.

NEWTOUCH COMPACT KEYBOARD

The Logitech NewTouch Compact keyboard combines a comfortable split contoured key layout with a space-saving design that fits easily into your work environment.

IOLOG019 **$95**

Sales staff are available (est) 9am-6pm Monday to Friday, 10am-4pm Saturday
Technical Support (5 Days a week 9am-6pm) Phone (02) 8344 3160

Sales Hotline 02 8344 3190

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Swann COMMUNICATIONS

Modems

Specifically designed to suit Australian conditions the SwannSmart 56K line of modems bring a hassle free personal fax, data and voice telecommunication centre right to your fingertips!

SwannSmart 56K

The SwannSmart 56K modem brings full communication capabilities to your desktop today. Featuring a download speed of 56Kb/s and Group 3 faxing the SwannSmart 56K is available in both an external & internal version.

- ITU V.90 Standard
- Enhanced ADPCM CODEC for Voice
- Data Compression rates to 115,200bps
- Auto Dial & Answer
- Auto Power Management
- Answering Machine / Voice Mail
- 5 Year limited warranty

5 YEAR MANUFACTURERS WARRANTY

PC User BEST BUY

External **$159** FMSWA000

Internal PCI **$89** FMSWA001

FREE WEBWORKS 99 INTERNET TOOLKIT

SwannSmart 56K Global PC Card

Specifically designed to suit conditions almost anywhere in the world the SwannSmart 56K PC-Card brings a complete data communication centre to your laptop computer....anywhere!

- ITS V.90 & 56Kflex Standard
- Location selection utility automatically configures your modem settings relative to the country's standard
- Phone Cable Adaptor for various countries
- Countries supported include Australia, UK, USA, Taiwan, HK, Canada, Japan, Germany to name a few

Use in 27 Countries

$185 FMSWA002

TOLL FREE Customer Support Number 1800 066 336

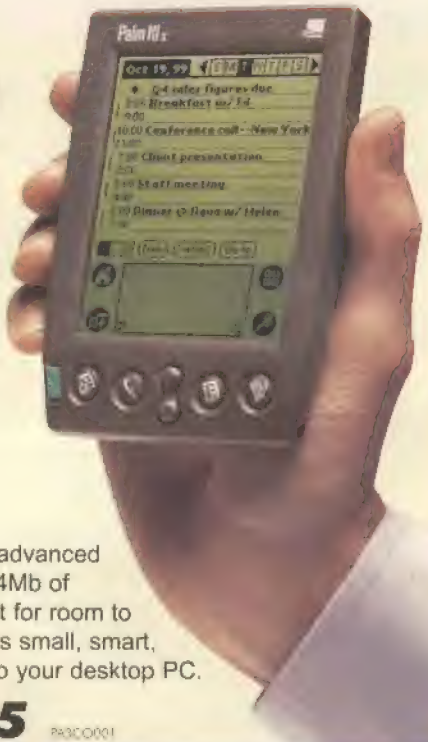
Digital Assistant

3Com® More connected.™

Palm III™ Connected Organizer

$625 PA3CO000

The Palm III is just 12cm tall and 161grams. With 2Mb of memory, store thousands of names, addresses, phone numbers, to-do's and expenses. You can synchronize all your information at the touch of a button via serial connection or IRDA, the Palm III is even internet ready.



Palm IIIx™ Connected Organizer

Palm IIIx™ organizer gives you an advanced LCD screen for razor-sharp clarity, 4Mb of memory and an open connector slot for room to expand. The Palm IIIx™ organizer is small, smart, easy-to-use and totally connected to your desktop PC.

$745 PA3CO001

Palm V™ Connected Organizer

The new Palm V™ weighs just 113grams, its ultra-thin exterior belies its organizational power. With 2Mb of memory you'll have thousands of names, addresses, phone numbers, appointments, to-do's, plus hundreds of e-mail messages at your fingertips. You can recharge the lithium ion batteries in the HotSync® cradle, a full charge lasts for up to a month.

$895 PA3CO002

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e.mail: info@adelong.com.au

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Modems & PC Cards

US Robotics 56K Voice Message Modems

Productive conference calls with the clarity and convenience of a top-quality full-duplex speakerphone - in the same device that brings the internet onto your desktop

Enhanced Features:
- Full Duplex Speakerphone
- Stores voice and fax messages even when your PC is switched off

STANDARD **$269** FMRC0011

Professional Modem includes the following extra features:
- Caller ID
- One button access to voice mail
- Independent Fax Forwarding

PROFESSIONAL **$295** FMRC0012

3COM Megahertz 56K Global Fax/Modem

- Enjoy high-speed downloads up to 56 Kbps with the V.90 & x2 56K standard
- Intelligent Auto Installation
- Configue your modem for use worldwide

$299 FMRC0000

3COM Megahertz 10/100 LAN x 56K Modem

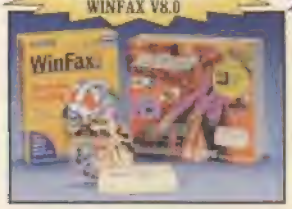
- 10/100Mbps Ethernet & Fast Ethernet
- Enjoy high-speed downloads up to 56 Kbps with the V.90 & x2 56K standard
- Intelligent Auto Installation
- Configue your modem for use worldwide

$419 FMRC0013

NetComm Roadstar II Ultra 56K

The Roadster II 56 Ultra SVD is a voice/data/fax modem which lets you transmit and receive faxes and data directly from your desktop. The USB version goes further eliminating the need for the a power supply.

HEADSET INCLUDED
FREE COPY OF SYMANTEC WINFAX V8.0



$275 FMNET015 USB

SERIAL **$259** FMNET012

NetComm Card Modem 56K Global GSM

Gives the world traveller the freedom of data connection either through a land line or mobile phone (GSM), with data download speeds of up to a scorching 56,000bps.

WORD WIDE COMPATIBILITY **$335** FMNET017

NetComm CardModem56

Netcomm CardModem56 The CardModem56 Combo is the ideal PCMCIA modem if you demand the ultimate in speed and portability

$285 FMNET013

SPECIAL OFFER:

Netcomm 10/100 PCMCIA Ethernet

Connect to both 10 & 100Base-T networks with a dual speed Ethernet PCMCIA card.

~~$249~~ **$149** NWNET0000

SPECIAL OFFER

PC Cards

Xircom

Xircom Realport Ethernet 10/100

The RealPort Ethernet 10/100 offers mobile users high-performance 10Mbps and 100Mbps Ethernet connectivity in a robust Integrated PC Card with a built-in connector. BatterySave™ power management reduces power when the adapter is not in use.

$279 NWXIR009

Xircom Realport Ethernet 10/100+Modem 56

The RealPort Ethernet 10/100+Modem 56 combines 10/100Mbps Ethernet, 56K modem, GSM, AMPS cellular and ISDN connectivity, in a single cable-free Integrated PC Card solution. GlobalACCESS™ features make it easy to connect anywhere in the world.

$655 NWXIR008

Xircom Realport 56

The RealPort Modem 56 offers mobile users high-speed 56K modem functionality in a robust Integrated PC Card with built-in connectors. Supports ITU V.90 standard.

$265 FMXIR003

Xircom Realport Modem 56-GlobalACCESS

The RealPort Modem 56-GlobalACCESS offers mobile users high-speed 56K modem and optional GSM, AMPS cellular and ISDN functionality in a robust Integrated PC Card with built-in connectors

$325 FMXIR004

WORD WIDE COMPATIBILITY

Sales staff are available (est) 9am-6pm Monday to Friday, 10am-4pm Saturday
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Sales Hotline 02 8344 3160

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Monitors

MITSUBISHI ELECTRIC
EXCELLENCE THROUGH INNOVATION

3 YEAR ON SITE WARRANTY*

Mitsubishi Diamond View 1995 19"

$1225 PRICE DROP

MOMIT005

- High contrast 19" picture tube with 18" viewable.
- Maximum Resolution 1600 x 1200 pixels at 75 Hz

'the only 19" to equal & better Sony in our tests'

Editor's Choice apcmag

APC MAGAZINE APRIL 1999

Mitsubishi Diamond View 1554 15"

- Advanced Plug & Play
- Superior image fidelity 0.28 Dot Pitch
- 13.6" True viewable
- Maximum Resolution 1024x768 up to 65Hz

$325 MOMIT003

Mitsubishi Diamond View 1772E 17"

- Advanced PnP compatibility
- 15.9" True Viewable
- 0.27Dot Pitch
- Maximum Resolution: 1280x1024 up to 60Hz

$595 MOMIT002

Mitsubishi Diamond Plus 71 17"

pc world BEST BUY

- Super-fine aperture grille
- 16.0" True viewable
- 0.25mm Dot Pitch
- Maximum Resolution 1280x1024 up to 65Hz

PC & MAC Compatible

HOT SPECIAL **$695** MOMIT001

Diamond Plus 72 17" Monitor

- 0.25mm Dot Pitch
- Aperture grille
- Max Resolution 1600 x 1200 at 65Hz
- Apple Mac Adaptor Included
- 16" Maximum viewable

$845 MOMIT004

Mitsubishi Diamond View 2107 21"

- 0.26mm Dot Pitch
- 20" Viewable
- Max Resolution 1600 x 1200 at 80Hz
- 15 pin & BNC output

'Compared to the Sony Trinitron, the Diamond View scored equal to, or better than in every regard, apart from brightness'

Editor's Choice apcmag

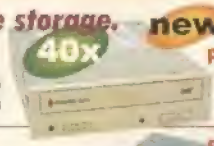
APC MAGAZINE APRIL 1999

$2095 MOMIT006

VALUE

Storage

The new standard in diskette storage.



new

Code	Model	Price
MMMIT003	Mitsubishi Diamond Data 36X CD-ROM	$95
MMMIT001	Mitsubishi Diamond Data 40X CD-ROM	$105

Code	Model	Price
BUMIT000	Mitsubishi LS – 120 – 120MB Capacity.	$169

Mitsubishi LS-120 FACTS:

- Large storage capacity of 120MB in a single LS-120 diskette.
- 100% compatibility with existing 3.5" diskette media

BUMIT001	120MB capacity diskettes to suit LS – 120 Drive	$25

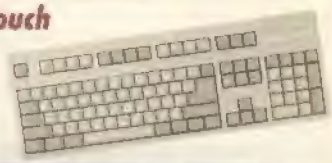
Code	Model	Price
FDMIT000	Mitsubishi Diamond Data 1.44MB Floppy disk drive.	$36

Keyboards

Mitsubishi Diamond Touch Ergonomic Keyboard

$49 KOMIT001

Mitsubishi Diamond Touch Economical Keyboard



$30 KOMIT000

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Ph: (02) 9267 5272
Fax: (02) 9267 5042

Monitors

Videocom

Model	17"DC-770BA	17"DC-770LAT	19" DA-995
Screen Size	16" Viewable	16" Viewable	18"Viewable
Dot Pitch	0.27mm	0.25mm	0.25mm
Max Resolution	1280 x 1024 N/I	1280 x 1024 N/I	1600 x 1200 N/I
User Control	OSD	OSD	OSD
Price	$495 MOVID000	$575 MOVID002	$949 MOVID001

HOT SPECIAL

3 YEAR ON SITE WARRANTY*

*QUEENSLAND, NSW, VICTORIA ONLY

Monitors

Panasonic

Panasonic's NEW Digital technology sets the standards for Top performing high-end monitors. All monitors feature true-type colours, excellent focus and convergence, power saving functions and crystal clarity in colour display.

PanaFlat LC50

15" colour monitor with state-of-the-art design creating a slim profile.

Specifications

- 15" flat screen monitor
- 0.297mm dot pitch
- Built in Multimedia Speakers
- On-Screen display controls
- 1024x768 max.res.
- 15" viewable area

PRICE DROP

$2299 MOPANO13

PanaSync SL70

17" Digital Multiscan colour FST display. The monitor that's very sharp and compact in size.

Specifications

- 17" flat screen monitor
- 0.27mm dot pitch
- Advanced anti-glare, anti-static coating
- On-Screen display controls
- 1280x1024 at 65Hz.
- 16" viewable area

$785

PanaSync E50i 15" **$345**

PanaSync E70 17" **$645**

PanaSync SL90

19" monitor with a large 18" true viewable area. Super sharp and compact in size.

Specifications

- 19" flat screen monitor
- 0.25mm dot pitch
- Advanced anti-glare, anti-static coating
- On-Screen display controls
- 1600x1200 max.res. at 75Hz
- 18" viewable area

PRICE DROP

$1375 MOPANO11

PanaSync S110

The 21" monitor that takes brightness to a new level and places its focus on high image quality.

Specifications

- 21" flat screen monitor
- 0.25mm dot pitch
- Anti-glare, anti-static coating
- On-Screen display controls
- 1600x1200 max.res.
- 20" viewable area

$2135 MOPANO01

Sales staff are available (est) 9am-6pm Monday to Friday, 10am-4pm Saturday
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Sales Hotline 02 8344 3190

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RICOH CD RW Drives

A single drive that does it all. Reads, writes, Rewrites CD data.

Ricoh's MP7040 drive handles both CD-R and CD-RW discs. Providing an access speed of under 120msec, the MP7040A offers 20x reading of CD-R discs, 8x reading of CD-RW disks, and MultiSpeed 1x, 2x and 4x writing of both disks to meet every need. You can also depend on reliable writing with fewer interruptions thanks to Running OPC (Optimum Power Control) and a built- in 2MB buffer memory that helps eliminate buffer under-run a cause of writing errors.

Easy and simple just like a floppy

- 4x Recording 4x Rewriting & 20x Reading
- Drag & Drop operation just like a floppy disk
- For data distribution, back up and creating original CDs

- Complete package including everything to start writing CD-R/RW
- Adaptec Direct 2.5, Easy CD Creator software
- 2MB data buffer memory • 120ms access time

MP6200AR (EIDE) ATAPI
$599 Kit includes $35 of Media products
CDR 6x Read, 2x Rewrite Drive

UPS & Line Filters

Information stored on computers and distributed via the computer network is of vital importance for a small business. MGE UPS SYSTEMS is the first UPS manufacturer to design a range of UPS that meet the specific requirements and restrictions of small business staff and management: the price is reasonable and the package is easy to install and use.

	ES2+	ES5+	ES8+	ES11+
Power	220VA	480VA	780VA	1080VA
No DF power output	2	2	4	4
Fax/Modem line			✔	✔
Backup time for PC	5 min	23 min	44 min	78 min
Price	$349	$435	$679	$1025
Code	PSMGE000	PSMGE001	PSMGE004	PSMGE005

ES + series for a total and manageable protection system
Plug and Play compatible, the solution - PAC 97-power management software games a powerful GUI interface to control features such as remove management and shutdown of multiply service.

	EL2	EL4	EL7
Power	220VA	450VA	750VA
No of power outputs	2	2	4
Fax/Modem Line			✔
Backup time for a PC	5 min	20 min	40 min
Price	$259	$335	$Call
Code	PSMGE002	PSMGE003	PSMGE006

Perfect for the Soho. the EL Series offers affordable protection for your equipment.

Power Filter — Computer and equipment protection!

Protect your expensive PC equipment with these power filters.
Provides protection against Surges and Spikes,
EMI and RFI noises

Code	Model	Price
PSGEN004	ZAPTRAP - Four individually wired sockets	$140
PSGEN005	ZAPCATCHER - Telacom Line protection	$150

3 YEAR REPLACEMENT WARRANTY

Protection for:
- Multimedia Computers
- Fax Machines
- Fax Switch
- Modems
- EFTPOS Terminal
- Cash Register
- Answering

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Sydney NSW 2000
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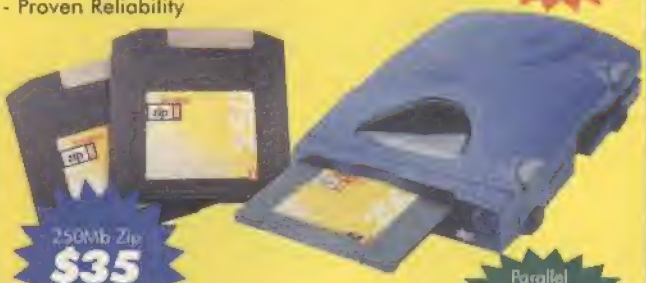
Fax: (02) 9267 5042

Zip 250

SuperFloppy Preferred By Millions
The new drive comes in two flavors: parallel port (for PC's) and SCSI (for Mac's or PC's with a SCSI connection). Zip 250 SCSI drive users will benefit from a performance boost, up to 56 times faster than standard floppy drives and 1.4 times faster than external CD-ROM drives. Best of all, current Zip 100 drive users need not worry about their investment in 100MB Zip using 250MB media).

- 50% faster than the original Zip 100 drive.
- Large 250Mb Capacity
- Compatible with 100Mb Zip Disk
- Proven Reliability

SCSI $389 BUIOM032



250Mb Zip $35 BUIOM034

Parallel $389 BUIOM033

Zip Drives

Increase your storage quickly, easily and economically - as you need it. With a 100MB Zip Drive you can take your data anywhere at anytime. Each disk stores 100MB of data and you can add them, as your needs grow. Available in Parallel, SCSI and Internal IDE.

$195

Drives

BUIOM000	100MB ZIP Drive	$239
BUIOM001	100MB ZIP Drive SCSI	$239
BUIOM098	100MB ZIP Drive IDE ATAPI	$195
BUIOM026	100MB USB ZIP Drive	$295

Accessories for Zip

BUIOM012	100MB PC ZIP Disk	$24
BUIOM005	100MB PC ZIP Disk (3 Pack)	$63
BUIOM006	100MB PC ZIP Disk (10 Pack)	$190
BUIOM015	ZIP ZOOM SCSI Card	$55
BUIOM022	ZIP Card, PCMCIA to SCSI	$185

$185 BUIOM022

$24 BUIOM012

Jaz 2GB Drive

The new Jaz Drives hold a whopping 2GB of data per disk. Best of all these drives are fast and backwards compatible with the industry standard 1GB disk. Stream & capture video, backup data and store images are just some of the applications that the Jaz Drive can be used for. SCSI Card needed.

$745

$745

Accessories for Jaz

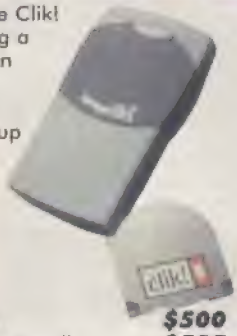
BUIOM024	JAZ 2GB Disk	$195
BUIOM025	JAZ 2GB Disk (3 Pack)	$559
BUIOM031	JAZ PCMCIA to SCSI Converter	$215
BUIOM013	JAZ Traveller, SCSI to Parallel	$85

$179

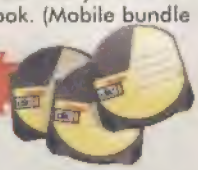
$85 BUIOM013

Click!

Clik!™ drive can store 40Mb of data on a Clik! Disk. The Click Drive not only reads your Clik! Disk but also your Compact Flash and Smartmedia cards.The Mobile Clik! Drive connects to your printer port using a pass through technology and can run on rechargable batteries for mobile applications. There is even a Type II PC Card that will connect your Clik! Drive up to your notebook. (Mobile bundle only)



$20



BUIOM035	Clik Camera Bundle	$500
BUIOM036	Clik Camera+Mobile Bundle	$585

Iomega Buz

All the hardware and software you need to be a video genius Introducing the Iomega Buz-the easiest way to get multimedia from camcorders, DVD, CD-Roms, VCRs and laserdiscs into your PC! It's a video capture and editing board combined with an Ultra SCSI controller that lets you capture Multimedia (fullmotion) video, sounds, digital pictures, music) into a PC

$525

$359 BUIOM023

Available in Mac format

Kodak CDR/Digital Camera

Kodak, the world's largest manufacturer of CD-R media, has announced an all-new Windows 95/98/NT CD-R/RW drive. The Kodak 4802 internal ATAPI drive supports 8x read, 4x write and 2x rewrite. The new drive combines new Disc-at-once technology along with the capability to write data, audio, video CD and hybrid formats. The kit includes cables and integrated software and media.

Playback Speed	1200KB/s (8x Speed)
Recording Speed	600KB/s (4x Speed) CD-R, 2x Speed CD-RW
Buffer	2 MB
Interface	ATAPI Enhanced IDE
Compatibility	Windows 95/98/NT Compatible
Note:	Packet CD software Windows 95/98 compatible only - a patch will be available for NT soon
Form Factor	5 ¼", Half Height
Mitsumi Software	CD contains WinOnCD, Packet CD and Gazo Personal Image Warehouse software
Package contents:	Kodak 4802IDE CD-R/RW Writer
	CD-R Disc
	CD-RW Disc
	IDE Cable
	HiFi Cable
	Mounting Screws
	Mitsumi Software CD and diskette

$499

Kodak's new digital cameras boast high resolution and great features.

Kodak DC200plus

$749

The KODAK DC210plus Digital Camera gives you the power to capture amazing, high quality images (1152 x 864) with vivid colour and enough dazzling detail for photo-realistic 5" x 7"prints. With a focus-free lens, auto-exposure and white balance, easy-to-use graphic interface and mode dial, built-in flash with red eye reduction, self-timer and all the ease of a pocket-sized, point-and-shoot camera. The DC200plus camera also comes with a 8Mb picture card for removable storage of up to 120 pictures..

DC200/210plus Front

Kodak DC210plus

$999

The DC210 plus delivers spectacular detail, colour, and sharpness thanks to megapixel technology (1152 x 864) and a 2X wide-angle zoom lens, equivalent to 29-58 mm on a 35 mm camera. The DC210 Plus also has the user-friendly features, greater storage capacity with an 8 MB Picture Card, and an AC adapter right in the box. The colour LCD allows you to review/preview pictures instantly so you know you've got the shot you wanted.

DC200/210plus Back

Kodak DC240

$1199

The latest from the Kodak range, supports serial and USB transfer. Featuring 1.3 million pixels (1280x960), this is the highest resolution camera from Kodak. Features an auto focus 3x zoom lens and 1.8" TFT screen. Everything you need is included in the kit, 4x AA Nimh batteries and charger, 8Mb Compact Flash card and all the software needed. All serial and USB cables are included, even a TV output cable is included.

DC240 Front

INTERNET WEB SITE:
http://www.adelong.com.au
e.mail: info@adelong.com.au

HEAD OFFICE & SERVICE
54 Rosebery Avenue
Rosebery NSW 2018
Ph: (02) 9344 3188
Fax: (02) 9697 9777

CITY OFFICE
127 York Street
Sydney NSW 2000
Ph: (02) 9267 5272
Fax (02) 9267 5042

Video & Capture Cards

MIROVIDEO PCTV

MiroMedia PCTV is the first multimedia auxiliary card that supports INTEL's Intercast Technology. You can now watch TV (Full screen or scalable window), capture your favourite video, or frame, use Teletext and enhance your web pages all on your PC. Runs on Windows 95/98 & NT.

MMMIR000 **$262**

MIROVIDEO PCTV PRO

The Miro PCTV Pro has all the features of PVTV plus a built-in FM radio Tuner. You can also listen to TV in full Stereo , together with Intercast Broadcast, Captures videos and listen to CDs or the radio in stereo.

MMMIR005 **$365**

MIROVIDEO DC30 PLUS

The new generation audio/video editing card for PC users. Benefit from miroINSTANT Video software to break the the 2Gb playback barrier, reduce hard drive requirements and speed up production time. Package includes Adobe Premier 5.0, Miro Instant Video, Adobe Photoshop V3 LE and the new Pinnacle Title Deko & Spice Rack. Compression rates up to 7Mb per second, video can be compressed down to 3:1 in PAL. Runs on Windows 95/98 & NT.

MMMIR002 **$2045**

STUDIO DC10 PLUS

If you want to create great looking videos from your desktop in a hassle-free, cost-effective manner, look into Studio DC10 plus. It's from Pinnacle Systems, the leader in video capture, with more than ten years of experience in video. Studio DC10 plus is a Motion-JPEG PCI internal board that captures full resolution (640 x 480) video to your hard drive for editing.

MMMIR004 **$675**

Scanners

UMAX

UMAX 610

The new UMAX 610 colour scanner is most affordable scanner. It features high optical resolution of 600 dots per inch and simple Parallel Port connection means no hassles installation and setup.

Specifications:

- Connectivity: Parallel Port Pass through/SCSI
- Colour: Colour & Monochrome
- Resolution: 600 dots per inch, 4800 dots per inch enhanced
- Colour: 30-bit
- VistaScan

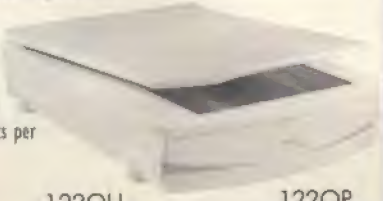
610P **$145** IOUMA002 610S **$279** IOUMA003

UMAX 1220

The Astra 1220 series was designed specifically for corporate or small office users who want something more from their scanner. Built with a 36 bit colour CCD, the Astra 1220 captures an amazing 68.7 billion colours to bring all your images to life.

Specifications:

- Connectivity: USB Parallel Port SCSI
- Colour: Colour & Monochrome
- Resolution: 1200x600 dots per inch Hardware Super Sampling, 9600 dots per inch enhanced
- Colour: 36-bit
- VistaScan



1220S **$495** IOUMA005 1220U **$345** IOUMA006 1220P **$279** IOUMA009

HEWLETT PACKARD

HP ScanJet 4200C

The new HP ScanJet 4200C colour scanner is designed to simplify colour scanning. With push-button scanning and push-button colour copying, anyone can get great results with the HP ScanJet 4200C. The Universal Serial Bus (USB) means effortless, trouble-free installation and use. All at a truly affordable price.

Specifications:

- Connectivity: Conflict-Free USB
- Colour: Colour & Monochrome
- Resolution: 600 dots per inch Hardware Super Sampling, 9600 dots per inch enhanced
- Colour: 36-bit
- HP's PrecisionScan LT

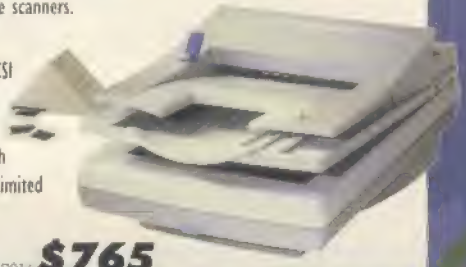
IOAHD027 **$385**

HP ScanJet 6200C

Productivity means completing your task quickly -with the quality you need. With the HP ScanJet 6200C Professional Series colour scanner, you can be up to 4 times more productive than with comparable scanners.

Specifications:

- Connectivity: USB and SCSI (SCSI card and Cable not supplied)
- Colour: Colour & Monochrome
- Resolution: 1200 dots per inch Hardware Super Sampling, unlimited enhanced resolution
- Colour: 36-bit
- HP's PrecisionScan Pro



IOAHD014 **$765**

Sales staff are available (est) 9am-6pm Monday to Friday, 10am-4pm Saturday
Technical Support (5 Days a week 9am-6pm) Phone (02) 8344 3160

Sales Hotline 02 8344 3100

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Canon Printers

PORTABLE

BJC-50

$585 PRCAN020

- Half the size of the BJC-80 but not half the performance.
- Featuring a InfraRed Port and Lithiumion Battery which is good for 100 A4 prints. Maximum resolution of 720dpi at up to 5.5ppm
- Snap in the optional scanner head for 360dpi full colour scanning.

Instant Scan Capabilities

IS-12 Scanner head $137 PRCAN001

BJC-80

$345 PRCAN000

- Drop Modulation Technology - the dual drop size breakthrough that produces smoother colour gradations.
- Office laser quality finish & B&W speeds up to 5 pages per min. with dedicated black cartridge.
- Windows® 95 compatible IrDA infrared port for cable-less communications.

Instant Scan Capabilities

IS-12 Scanner head $137 PRCAN001

BJC-4310SP

$199 PRCAN021

NEW IMPROVED SUPER ECONOMY MODE

- drop modulation technology uses dual drop sizes for smoother colour graduations
- optional photorealism inks for photo gold standard printing
- speed black cartridge prints up to 4.5ppm

Instant Scan Capabilities

IS-22 Scanner head $137 PRCAN019

BJC-255SP

$145 PRCAN017

- Super Economy mode for colour and B&W.
- New high capacity black cartridge 20% more ink, no extra cost.
- Up to 5 times the output of direct competitors.

BJC-5000

$523 PRCAN022

- 1440 dpi resolution for photographic reproduction
- A3 capable via manual feed
- 7 colour photo inks
- The dual cartridges print up to 7.5 pages per minute in black and up to 3 pages per minute in colour.
- 130 Page sheet feeder

BJC-7100

$523 PRCAN012

- 1200 DPI
- 8ppm Black and 5ppm colour
- 7-colour ink system and 9 saturation incredibly rich photographic half-tones.
- P-POP (Plain Paper Optimised Printing) gives plain paper a coated paper quality finish.
- 130 Page sheet feeder

LBP-660

$515 PRCAN011

- High Speed 6ppm engine
- 600 DPI for quality to rival its more expensive competitors
- 100 sheets automatic feeder
- Windows Printing System and PCL4

FAST LASER PRINTER

FB320P

$175 IOCAN002

All the advanced technology of the 620P at 300 dpi

FB620P

It takes up less desktop real estate than any other colour flatbed scanner on the planet yet still delivers exceptional 600 dpi scanning.

- Optical Resolution 600 dpi
- Maximum Resolution 2400 dpi x 2400dpi
- 30 bit Colour

$265 IOCAN003

PowerShot A5

$975 IOCAN004

- The new Canon PowerShots A5 is everything you've always wanted from a digital camera. In fact, it's the smallest digital camera ever engineered with 1024 x 768 (XGA) resolution.

- Complementing its ultra-sensitive, high resolution CCD, the PowerShot A5 comes with a high-quality, low-distortion, all-glass lens, ensuring consistently sharp images. Plus, the unique Stitch Assist mode makes it easy to create dramatic panoramas.

CALL FOR COMPLETE RANGE OF CANON INKS AND CONSUMABLES

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127 York Street
Sydney NSW 2000
Ph: (02) 9267 5272
Fax: (02) 9267 5042

Printers

EPSON

STYLUS COLOUR 640

Print up to 3PPM,With its remarkable 1440 x 720 dpi capability, the Epson Stylus COLOUR 640 sets a new standard for cost-efficient, photo-quality colour printing without the need for expensive options.

$320 PRHPD000

STYLUS COLOUR 740

EPSON Stylus 740 is targeted at business/corporate and professional graphics users. Designed for both Windows and Macintosh.Printing at 1440 x 720 DPI and a maximum of 7ppm the Stylus 740 eclipses many desktop laser printers whilst providing unrivaled photo reproduction

$495 [illegible]

STYLUS PHOTO 900

The EPSON STYLUS COLOR 900 inkjet printer, the fastest colour inkjet in its class, printing at 12ppm. The The Stylus Color 900 has a maximum resolution of 1440dpi. It features autoswitching via parallel, serial and USB ports and has networking capabilities through an optional interface card.

$795 PRHPD004

STYLUS PHOTO 1200

EPSON STYLUS PHOTO 1200 Introducing the A3+, six-colour photo- reproduction quality inkjet printer for graphic artists and professional photographers. The PHOTO 1200 delivers 1440dpi, full-bleed A3 prints with ink droplets invisible to the naked eye. It includes parallel, Mac, serial and USB interfaces.

$975 PRHPD004

Item Code	Description	Price	Item Code	Description	Price	Item Code	Description	Price
PRHPD017	Stylus Colour 440	$255	PRHPD011	Stylus Photo 750	$445	PRHPD010	Stylus Colour 1520	$1295
PRHPD016	Stylus Colour 850	$675	PRHPD012	Stylus Photo EX	$769	PRHPD008	Stylus Colour 3000	$3500

Printers

HEWLETT PACKARD

$265 PRHPD039

HP Deskjet 695C

Featuring the latest in colour printing technology with Colour Smart II. Easy to use & install the Deskjet 695 will output 5ppm in black or 1.7ppm in colour at 600dpi

$335 PRHPD040

HP Deskjet 710C

Want photo quality printing that want cost the earth. Then the HP 710C is your ideal partner. Print black at 6ppm and colour at a staggering 3ppm. This stylish yet practical printer will handle a variety of papers including envelopes & cards.

new

$569 PRHPD011

HP Deskjet 880C

Super-fast printing and stunning results on plain paper is what to expect from the new HP 880C. Your black text will look more laser like while colour prints will bring life to your documents & images. Output is rated at 8ppm in black & 2ppm in colour. USB and Parallel interface

new

$1,425 PRHPD047

HP LaserJet 2100

Introducing the latest HP 2100 series of LaserJet printers. Great for workgroup computing the HP 2100 features a print resolution of 1200dpi, 10ppm output, 350-sheet feeder & a monthly print cycle of 15,000 pages

Item Code	Description	Price
PRHPD048	2100M with 8MB RAM, Postscript	$1595
PRHPD049	2100TN with 8MB RAM, Network ready, Ps	$1925

$799 PRHPD041

HP LaserJet 1100

Excellent for the home or small office, the HP 1100 produces stunning results whilst offering expandability and excellent value for money. JetPath technology allows you to upgrade the HP 1100 to include a scanner at any time.

$789 PRHPD033

HP OfficeJet 635

The OfficeJet 635 is an integrated fax, Colour printer, colour copier & colour scanner - all in one

Print: 600dpi at 5ppm in black & 2ppm in colour
Fax: Plain paper fax & 20 page document feeder
Scan: 1200dpi enhanced with OCR software
Copy: Resizable colour copying or B&W copies independent of the PC

Item Code	Description	Price	Item Code	Description	Price	Item Code	Description	Price
PRHPD043	Deskjet 895	$795	PRHPD046	LaserJet 1100A	$925	PRHPD031	Officejet 1100	$1369
PRHPD041	Deskjet 880	$569	PRHPD036	LaserJet 1100	$1355	PRHPD032	Officejet 1170	$1795

Sales staff are available (est) 9am-6pm Monday to Friday, 10am-4pm Saturday
Technical Support (5 Days a week 9am-6pm) Phone (02) 8344 3160

Sales Hotline 02 8344 3100

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Adelong Computers

D-Link Networking

Ethernet NICs

$60 NWDLI002

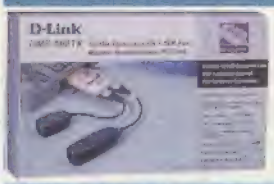
Ensure your future network upgrades are catered for with this 10/100 auto-negotiating network adapter. Plug & Play support for trouble free installation.

$199 NWDLI006

The ideal kit for beginners or enthusiast looking to set up a network. Includes 2 x 10Mbps Network cards, 2 x 7m CAT 5 cable & a 5 Port hub for future expansion.

Item Code	Model	Bus	Speed	Price
NWDLI000	DE-220PCT	ISA	10Mbps	$35
NWDLI001	DE-528CT	PCI	10Mbps	$40
NWDLI026	DE-500Tx	PCI	10/100Mbps	$85

Ethernet & Modem PC-Cards



PCMCIA 10/100Mb LAN & 56 Modem PC Card.

- V.90 Fax/Data Modem.
- Compatible with 10 & 100Mbps Networks

$425 NWDLI025

Item Code	Model	Description	Price
NWDLI003	DE-660CT	10Mbps PCMCIA Ethernet Card	$110
NWDLI013	DFE-650TX	10/100Mbps PCMCIA card	$225

Print Servers

Turn any printer into a network printer through D-Link's range of print servers. Just plug in your printer and connect the print server to your Network hub via Ethernet. Compatible with Win NT/ 95/ 98, UNIX, TCP/IP, NetBEUI, IPX & Appletalk Protocols. 10/100Mbps Enabled

$429 NWDLI015

Item Code	Model	Printers Supported	Price
NWDLI015	DP-300	2 x Parallel, 1 x serial, 10/100Mbps	$429
NWDLI023	DP-101	1 x Parallel, 10Mbps	$275

Fax/Modems

D-Link's range of Fax/Modems are V.90 &K56 Flex compatible utilising the high performance Rockwell chipset.

$135 INTERNAL NWDLI000

Item Code	Model	Description	Price
FMDLI000	DFM-560I	56K Internal Modem	$135
FMDLI001	DFM-560E	56K External Modem	$165
FMDLI002	DFM-MAC	MAC connectivity kit with software, cables for 560E	$49

Internet Servers

The DP-602 makes connecting your LAN to the Internet easier than ever by sharing one ISP Account with all users. Features include NAT, Dial-on-demand, DHCP and PPP. With support for both analogue modems and BRI ISDN T/A the DP-602 also allows the use of both COM ports for double bandwidth.

$479 NWDLI027

Ethernet & Fast Ethernet Hubs

D-Link's range of hubs provide easy connectivity options for Ethernet users as well as a cost effective way to upgrade to Fast Ethernet networks.

10Mbps Ethernet Hubs

Item Code	Model	Ports	BNC / AUI	Price
NWDLI017	DE-805TP	5 UTP		$99
NWDLI004	DE-809TC	8 UTP	BNC	$149
NWDLI028	DE-809TP	9 UTP		$149
NWDLI029	DE-810TAC	8 UTP	✔	$269
NWDLI005	DE-816TP*	16 UTP	✔	$325
NWDLI030	DE-824TP*	24 UTP	✔	$485

100Mbps Fast Ethernet Hubs

Item Code	Model	Ports	Price
NWDL031	DFE-816STX	16	$1095

10/100Mbps Nway Dual Speed Hubs

These Dual Speed Hubs provide a network that is compatible with a mixture of 10Mbps & 100Mbps users.

Item Code	Model	Ports	Stackable	Price
NWDLI027	DFE-904	4		$226
NWDLI012	DFE-908X	8	✔	$735
NWDLI014	DFE-916DX	16	✔	$1195
NWDLI020	DFE-2624X*	24	✔	$2025

*Rackmount 19"

Ethernet & Fast Ethernet Switches

For a cost effective solution aimed at reducing network congestion look to D-Link's range of switches for improving network performance.

DES-1008 8x10/100NWAY

$1,645 NWDLI022

Item Code	Model	Ports	10Mbps	100Mbps	Price
NWDLI011	DES-810	10	8	2	$859
NWDLI021	DES-815	15	12	3	$1195
NWDLI032	DES-1016	16	✔	✔	$2121
NWDLI022	DES-1008	8	✔	✔	$1645

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DAT Backups

Seagate

Backup your data with the best in the business. We now carry a Full range of Tape and DAT backup systems from Seagate.

HORNET TRAVAN

Cost effective, Entry Level internal storage for Desktop applications, Servers and High-End Workstations.Kits Includes Seagate Backup Exec Windows 98 Version 3

Seagate Backup Exec Desktop 98 provides a powerful feature-set with the easiest-to-use interface for reliable, automated Windows 98 and Windows 95 data protection. Integrated Emergency Recovery feature rebuilds your entire system without reinstalling the operating system or the backup software. Selectively locate files with the File Find feature for specific data restores.

Model	STT28000N-RFT	STT28000A-RFT
Capacity	8Gb Travan TR4	8Gb Travan TR4
Form Factor	5.25"/3.5" H/H SCSI,	5.25"/3.5" H/H EIDE,
Inclusions	Seagate Backup Exec, Tape	Seagate Backup Exec, Tape
Price	**$595** BUSEA001	**$525** BUSEA000

SCORPION DAT

Highest Performance and Capacity, Low Cost, Multigigabyte Data Protection for High-End Servers and Workstations Kits Includes Windows NT Workstation Version 2

Seagate Backup Exec is comprehensive, easy to use, 32-bit data protection for Windows NT Workstations 4.0. Built-in device detection automates setup and the simple push of a button launches backups or restores. It reliably protects NetWare data, including Bindery and Trustee Information as well as guarantees consistent and reliable unattended backups with advanced Scheduling and the AutoProtect feature.

Model	STD28000N-RFT	STD68000A-RFT
Capacity	8Gb DDS-2 DAT	8Gb DDS-2 DAT
Form Factor	Internal - 3.5" / 5.25" SCSI,	External - 3.5" / 5.25" SCSI,
Inclusions	Single Server, Backup Exec S/W for NT and Netware, 2 Tapes	Single Server, Backup Exec S/W for NT and Netware, 2 Tapes
Price	**$2,025** BUSEA002	**$2,345** BUSEA003

HORNET

All Seagate Backup systems comes with award winning software

SCORPION

Networking

NETGEAR

Analogue Router + 56K Modem

COMPLETE SOLUTION FOR SOHO INTERNET ACCESS

Share Internet access with your small office/home users with the RM356 Analogue Router. Using a single ISP account and phone line users can now check email, browse the Internet & download information simultaneously. Connect up to 4 computers to the RM356 or connect the RM356 to your hub for unlimited connections.

- Built in 56K V.90 modem and integrated 4 port hub
- Supports Dynamic IP, DHCP, NAT, PPP

$599

NWNGR017

RT 328 ISDN Router

The NETGEAR RT328 ISDN Router provides Internet access, LAN-to-LAN Intranet connection, and remote access for a single user, a small business, or a branch office over ISDN. The RT328 combines the latest in networking technology, found only in high-priced business models, with ease-of-use designs and a price affordable office.

- Dynamic NAT enables entire workgroup to share an Internet Connection
- Supports PPP& 128Kb MultiLink PPP, TCP/IP, RIP, DHAP
- Firewall Security & Control, Callback
- Simple configuration with Windows GUI or Telnet
- Use DHCP to assign addresses for IP Gateway, DNS for LAN
- 2 Analogue POTS, 1 10BaseT Connection

$715

NWNGR018

NETGEAR Print Servers

NETGEAR print servers enable you to connect printers to the network for sharing among multiple PCs. Compared to attaching a printer to your PC, the print server gives more cost effectiveness, better performance, and simultaneous support for Windows, Netware, and UNIX printing.

- PS104AU NWNGR001 **$315**

Perfect for the SOHO user, the PS104 supports 1 Parallel printer and up to 4 PCs via its built in 4-port 10Mbps Ethernet hub. Connect the PS104AU to a hub for unlimited connections.

- PS110AU NWNGR001 **$395**

Connect up to 2 Parallel printers to the PS110AU. Attach the PS110AU to any 10/100Mbps network.

Ethernet Hubs

Choose from a range of 10Mbps and 100Mbps Ethernet Hubs

Code	Description	10Mbps	100Mbps	Rackmount	Price
NWNGR007	EN116AU 16 Port Hub with BNC	✔			$215
NWNGR012	ED516AU 16 Port Hub with BNC	✔		✔	$295
NWNGR013	EN524AU 24 Port Hub with BNC	✔		✔	$415
NWNGR014	DS108AU 8 Port Dual Speed Hub	✔	✔		$435
NWNGR019	DS516AU 16 Port Dual Speed Hub	✔	✔		$1175
NWNGR020	DS524AU 24 Port Dual Speed Hub	✔	✔		$1615

Sales staff are available (est) 9am-6pm Monday to Friday, 10am-4pm Saturday
Technical Support (5 Days a week 9am-6pm) Phone (02) 8344 3160

Sales Hotline 02 8344 3100

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Data Switches

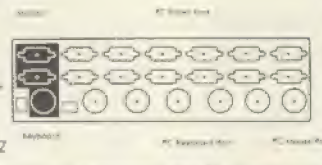
Never again will you need multiply monitors, keyboards and pointing devices with the range of CPU Switching devices. A single keyboard, mouse and monitor can control up to 8 computers simultaneously without any cable changes. These CPU Switches are digital and require only the push of a button. Excellent for network administrators or anyone who wishes to control 2 or more computers hassle free!

Features: • Supports Mouse/KB emulation for automatic bootup • Supports VGA, SVGA & Multisync monitors • LED's give current status • Easy to install & use

AT CPU Switches

for computers with serial mice & DIN Keyboard interface

- Supports Serial Mouse, 5DIN keyboard, standard 15PIN VGA connector
- Use hot keys (kb) or buttons to switch between computers
- VGA Bandwidth of 100Mhz
- Support up to 1024 x 768 Mhz @85Hz



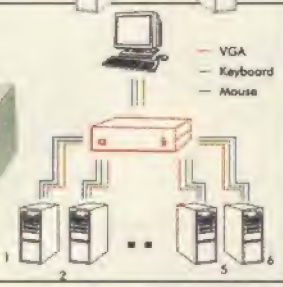
- CS-102

Control up to 2 PCs with the CS-102

DSADE030 **$245**

- CS-106

Control up to 6 PCs with the CS-106



DSADE020 **$395**

- CS-128

8 Port Switch Box AT & PS/2

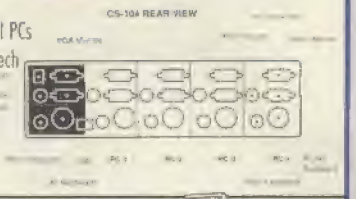
DSADE036 **$695**

Item Code	Description	Price
CBGEN127	AT CABLE SET for CS-128	$39
CBGEN128	PS/2 CABLE SET FOR CS-128	$39

AT and PS/2 CPU Switches

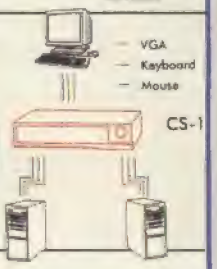
catering for all computers

- Use PS/2 or AT peripherals to control all PCs
- Supports Microsoft Intellimouse & Logitech Mouseman
- LEDs give current mode status
- CS-122 requires the input device to be PS/2 else convertor required



- CS-122 Switch between 2 PCs. Features:

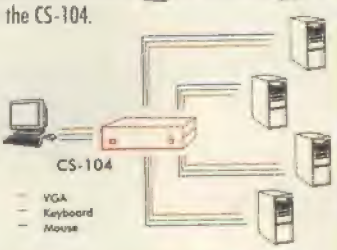
- VGA Bandwidth of 180Hz
- VGA resolution of 1600x1200 @60Hz



DSADE037 **$275**

- CS-104 Control up to 4 PCs with the CS-104.

- VGA Bandwidth of 100Mhz
- VGA Resolution of 1024x768 @80Hz

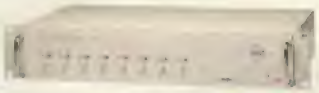


DSADE019 **$395**

DSADE038 **CS-114** (As CS-104 with support for Intellimouse) **$415**

- CS-138 Control up to 8 PCs with the CS-138. Features:

- VGA Bandwidth of 180Mhz
- VGA Resolution of 1600x1200 @60Hz



DSADE041 **$795**

CPU SWITCH CABLE SET

For use with the CPU Switches, each Cable Set connects 1 computer to the switch.

AT CABLE SET

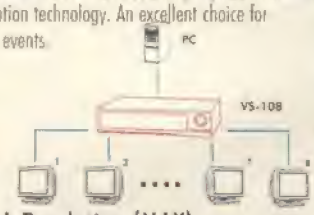
$35 CBGEN099

PS/2 CABLE SET

$39 CBGEN099

VIDEO SPITTERS

can duplicate PC video signals and amplify them for transmission to multiple monitors. These splitters are capable of supporting high band widths, which can easily accommodate the latest resolution technology. An excellent choice for presentations or broadcasting demos or special events.



Specifications:

- Max cable distance of 65 meters
- Supports VGA, SVGA & multisync monitors
- Slide switch for Video Signal Gain Control

VGA Bandwidth:

- VS-102 / VS-104 supports 200Mhz
- VS-108 supports 180Mhz

VGA Resolution (MAX)

- VS-102 / VS-104 supports 1600x1200 @70Hz
- VS-108 supports 1600x1200 @60Hz

VS-102

2 Port Splitter DSADE000 **$95**

VS-104

4 Port Video Splitter DSADE001 **$135**

VS-108

8 Port Video Splitter DSADE002 **$195**

1.8m Video Splitter to Monitor Cable **$9** CBGEN035

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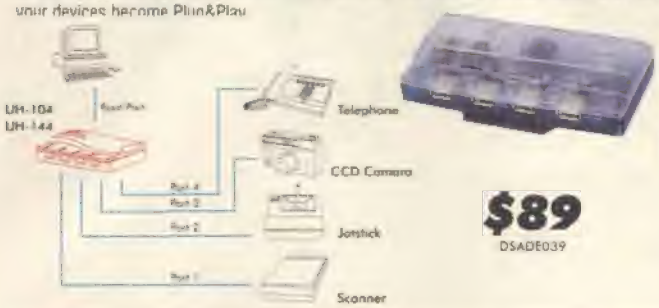
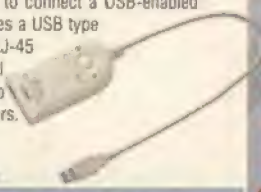


$89 DSADE039

USB ETHERNET ADAPTER

The ATEN USB Ethernet Adapter provides an easy way to connect a USB-enabled desktop or laptop PC to a 10BASE-T Ethernet LAN. It uses a USB type A receptacle for connection to the USB port and RJ-45 receptacle for connection to the network. No more internal PC cards to deal with. Just plug it in and your ready to go (PnP). Compatible with desktop and notebook computers. For use with IEE802.3 10Base-T LANs.



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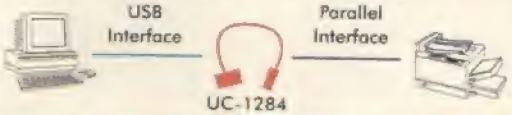
Connect your printer to your PCs USB Host controller with ease. Transparent and full automatic support for true bi-directional communication between your computer and your printer with no conflicts or installation hassles. Free up your parallel for other devices such as ZIP drives, Scanners and CD-ROMs by moving your printer to a USB port today!



$49 DSADE041

$15 CBGEN155
USB A CABLE

$15 CBGEN156
USB B CABLE

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With the UC-232, ATEN's new USB to Modem Adapter, installing an external modem is a snap. Free up your serial ports for other devices while IRQ conflicts will be a thing of the past. With our UC-232, installing a modem has never been easier. Just connect one end of the adapter to your modem and the other to your computer's USB port.

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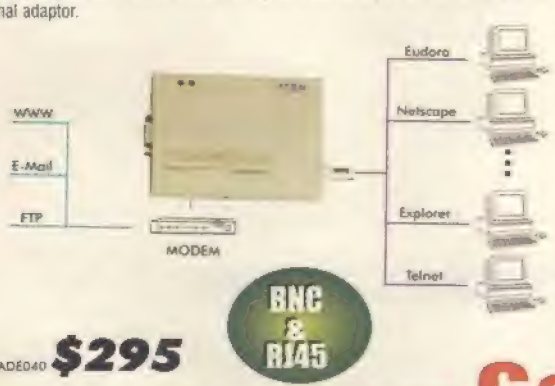

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$135 CAADE007

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Adelong Computers

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Commonly asked questions

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What do I do if my product has been damaged during delivery?

If your product has been damaged, our warranty manager may issue you with a returns number and arrange the collection and replacement. Please note that the collection and replacement may not be on the same carrier visit.

What do I do if I have received an incorrect product?

Ring the sales representative with whom you have originally placed the order. Discuss the problem with the Sales Representative to check if it is our misunderstanding. If it is our misunderstanding, we will pass your call through to the Warranty manager who will issue you with a returns number and arrange collection and replacement of the product.

What do I do if the courier arrives but the consignment note mentions more boxes than are being received?

Cross out the number of items listed and change it to read the appropriate number received. Ring your Sales Representative to contact the courier and to keep you informed.

What if my product won't work?

If you have our 3 year on-site warranty, call 1 800 623 394. If the problem is diagnosed as a software problem ring (02) 8344 3160 for a Technical Support Representative. Please call with the product on hand to evaluate any suggestions Technical Support will give you. If you do not have our 3-year on-site warranty, contact Technical Support. If your product has been diagnosed as faulty you will be issued with a returns number. Your Technical Representative will then arrange the collection process with you. Please note the RA # for future questions on the progress of your case.

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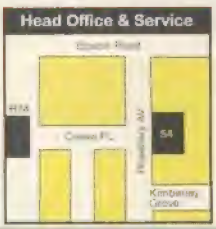

Important points to remember

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- Products will only be accepted back in there original condition.
- Warranty repairs – carriage must be paid for by the customer.
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TUTOR

Inkjet Printers

Improvements in speed and quality, combined with bargain-basement prices, have made the inkjet a hot item.

By Alfred Poor

You probably either own an inkjet printer already or are thinking of buying one. Once limited in resolution compared with lasers and occasionally plagued by problems with image accuracy, opacity, and smudging, inkjets have been greatly refined and now dominate the personal computer printer market. And for good reason: there are full-colour models available for under $200, and many inkjets now rival lasers for text quality and can produce photo-quality images. You'll get the most out of your printer if you understand how it works.

The concept of jet printers is simple—they squirt liquid ink onto paper—but they actually rely on highly sophisticated technology, in spite of their affordable prices.

THE FINE ART OF SPITTING

Current inkjet printers typically have resolutions of 600 dots per inch (dpi) or higher and print speeds approaching those of lasers when printing black and white. A fast inkjet printer can produce a full-colour, 300dpi, 8- by 10-inch image in two to four minutes. That amounts to producing 7.2 million dots in 120 to 240 seconds, or 30,000 to 60,000 dots per second. A typical inkjet printhead may have 64 nozzles for each colour, so these individual nozzles must be able to cycle on and off at rates as high as 900 times per second, which is remarkably rapid for a mechanical device.

In the early days of inkjets, the printheads were designed to emit a steady stream of tiny drops of ink. The drops were charged with static electricity and were then "steered" either onto the paper or into a recycling reservoir by charged fields. This was inefficient and not altogether accurate. Today, inkjet printers rely on drop-on-demand technology, which produces single droplets when needed. There are two methods inkjets use to achieve this speedy spitting: *thermal* and *piezoelectric*.

One of the legends of computer technology explains how the thermal inkjet was invented. An engineer was experimenting with ink formulations and had some loaded in a syringe. He accidentally brushed the needle against the hot tip of a soldering iron, and a tiny drop of ink shot out.

The contemporary inkjet head uses the same principle: the ink is loaded into a tiny capillary tube, and a tiny pad rapidly heats the ink to the boiling point. This creates a tiny bubble of steam, which expands and forces a drop of ink to the end of the tube. The heat is turned off, and the ink cools, causing the steam to condense and contract and stopping the flow of ink until the next bubble of steamis generated to create a drop of ink. The alternative approach is to use the piezoelectric effect, as Epson does with its inkjets.

Piezoelectric crystals have a unique and curious property. If you apply a physical force to them, they can generate an electrical charge.

USER TO USER

Controlling Quick Launch ToolTips in Windows 98; choosing an application to open files too big for Notepad; speeding up Word 97's shutdown; automating reactions to cell changes in Excel 97; and more. Page 163.

ENTERPRISE COMPUTING

Data warehousing means more than consolidating your information. Warehousing allows historical data to be extracted and analyzed in ways that help decision making. We look at various types of warehousing and offer some recommendations on which might be best for your organization. Page 168.

PC TECH

Distributed applications offer great advantages but present performance, reliability, and security challenges. We show how Windows NT's MSMQ service handles them. Page 170.

The process also works in reverse: apply an electrical charge to the crystal and you can cause it to move, creating a mechanical force.

A piezoelectric inkjet printhead uses a crystal at the back of a tiny ink reservoir. A current is applied to the crystal, making it pull inward. When the current is interrupted, the crystal snaps back to its original position, forcing a tiny amount of ink out through the nozzle. When the current resumes, the crystal pulls back, poised to propel the next drop.

This approach has its advantages. Piezoelectric printheads can use ink that dries faster and pigments that might be damaged by the temperatures in a thermal head. Also, a piezoelectric printhead is built into the printer, so only the ink cartridge needs to be replaced. (Thermal inkjets incorporate the jet nozzles into each ink cartridge, which can increase the cost of the cartridge and thus the cost per page.) The downside is that if a piezoelectric printhead is damaged or clogged, the printer must be repaired.

TINY BUBBLES

Whether heat or vibration is used to generate the droplets, the result is the same: tiny dots are placed on the paper. As the droplets get smaller, you can produce images with higher resolution and better colour. Early personal inkjet printers produced droplets that contained about 86 *picolitres* of ink each. A picolitre is one-trillionth of a litre, which means that it would take roughly 11.6 billion of these drops to fill a litre bottle. Over the years, the technology has been refined, and now inkjet droplets each contain about 10 picolitres of ink—100 billion to the litre.

These tiny droplets create marks that are about 50 to 60 microns (one-millionth of a meter) in diameter, less than the diameter of a typical human hair. The smallest-size dot that the unaided human eye can see is about 30 microns across, so these dots are approaching the limits of our perception.

The incredibly small size of these droplets makes it possible to increase the resolution of the printed output. It takes about a 35-micron dot to create an output of 720dpi, so these drops overlap slightly at that resolution. There is more to print quality than simply resolution: other factors play important roles in how we perceive the detail in a printed image. Some printers control the shades and intensity of colours by layering up to 16 droplets in the same space. This increases the number of colours created, improves anti-aliasing (getting rid of "jaggies"), and makes smoother transitions from one colour to the next.

INK SPOTS

The inks used in these printers are a lot more complex than you might think. The engineers who create them must consider a variety of factors, including drying characteristics and the pigments used. Today's inks dry faster than those used in the past. For black printing only, slow-drying inks are not too much of a problem, because text requires relatively small amounts of ink and will probably dry before the next sheet is placed in the output tray. If an image has large areas of black, however, the ink will take longer to dry and will be more prone to smudging. With colour images, slow-drying inks cause major problems as the inks run together and blur the results. A fast-drying ink lets you place another drop in the same spot without blurring.

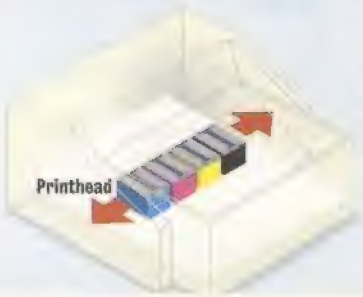
Another consideration is how the ink works with different print media. Standard copy paper is relatively porous, allowing the ink to dry faster but also causing the ink to be wicked along the paper fibers, expanding the dot size. On the other hand, overhead transparencies and some coated high-resolution papers are practically impervious to ink, and the inks must stick to the surface of the sheet yet dry rapidly enough that the image does not smudge.

Even the dyes used in the inks make a difference. Some pigments are made up of molecules smaller than 50 nanometers (nm), or billionths of a metre. These have the advantage of creating brighter colours, but they tend to fade after exposure to bright light and are more likely to be water-soluble. These are the dyes typically used for the cyan, magenta, and yellow inks. Pigments with molecules in the range of 50 nm to 100 nm are more waterproof and stand up to light better, but they are more opaque, so they're less suited for the layering required to produce many shades of colour. As a result, these are used mostly for black inks.

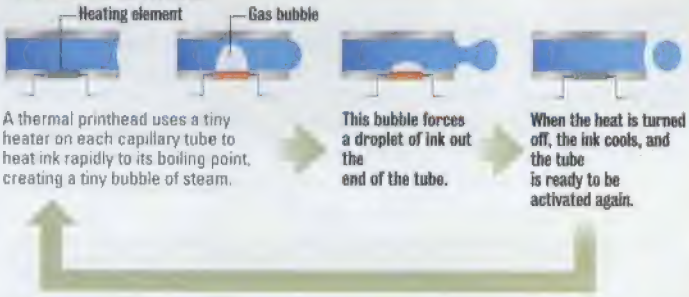
There are hurdles to cross before inkjets will be as fast as lasers, but don't bet against them. Their lower cost and excellent output quality have already all but eliminated impact dot matrix printers from the market, and it looks as if they will maintain their dominant position for a long time to come.

Ink Jet Printers

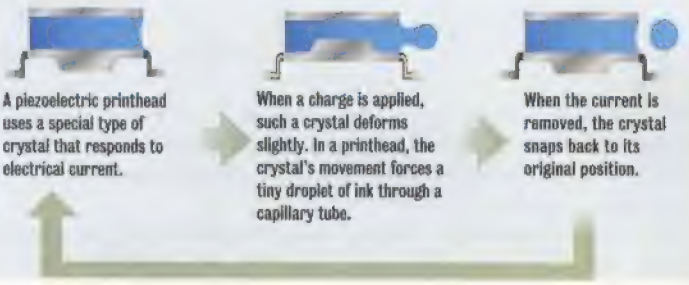
The heart of an inkjet printer is the printhead, which contains many tightly spaced capillary tubes. Tiny droplets of ink are forced out of nozzles at the ends of these tubes and land on the paper. Fast activation cycles, combined with tightly bundled nozzles and quick-drying inks, allow modern inkjets to offer resolutions of 600 dots per inch (dpi) or higher and black-and-white print speeds approaching those of lasers.



THERMAL PRINTHEAD



PIEZO PRINTHEAD



SOLUTIONS

USER TO USER

Controlling Quick Launch ToolTips

The Quick Launch toolbar in Windows 98 (or Windows 95 with Internet Explorer 4) actually gets its icons and ToolTips from the shortcuts stored in the folder C:/Windows/Application Data/Microsoft/Internet Explorer/Quick Launch.

So, if you drag a program to the toolbar you may end up with, for example, "Shortcut to Excel.exe" as the ToolTip. Edit the properties of the shortcut stored in the directory named above, and you can have a better icon with a more useful ToolTip, such as "Excel 97 with SR1".

Drew Dekreon
via the Internet

If you've enabled User Profiles on your system, the location for the shortcuts defining the *Quick Launch* toolbar will be C:\Windows\Profiles\username\Application Data\Microsoft\Internet Explorer\Quick Launch, where "username" is your user name. And, of course, if your Windows folder is something other than C:\Windows, the path to the location will begin with your particular Windows folder. However, you don't actually have to know either of these names. To work with the shortcuts in the *Quick Launch* toolbar, simply right-click the vertical "grab handle" at the left end of the toolbar and choose *Open* from the pop-up menu. This will also work for any user-defined toolbar and for the built-in *Links* toolbar. So, for example, renaming "Launch Internet Explorer Browser.lnk" to "Launch IE4.lnk" will change the text and ToolTip of the corresponding toolbar icon (Figure 1).

You can reduce the space used for a toolbar by suppressing its title and the titles of its icons. Right-click the toolbar's grab handle and remove the check marks in the pop-up menu next to *Show Title* and *Show Text*. You can still see the text for any of the icons; it appears as a ToolTip when you rest the mouse cursor over the icon. Note also that changes made to the *Links* toolbar will be mirrored in the *Links* toolbar within Internet Explorer 4. If the *Links* toolbar isn't visible, right-click the taskbar, choose *Toolbars* from the pop-up menu, and put a check next to *Links*.

—Neil J. Rubenking

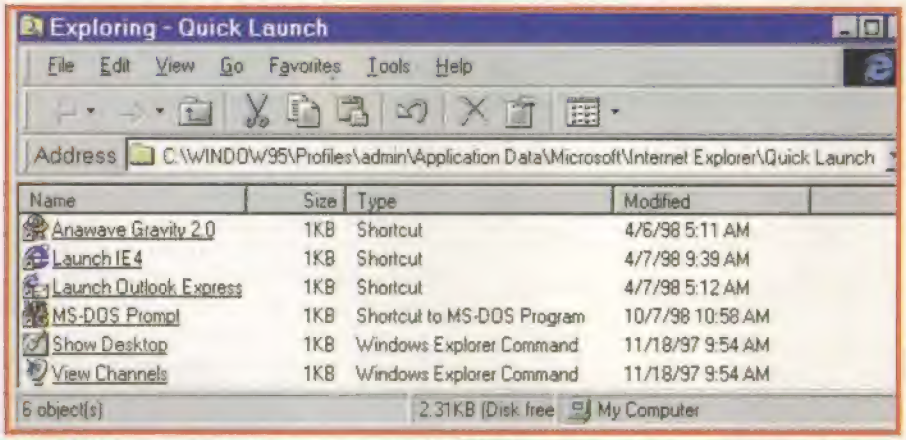


FIGURE 1: *The text and ToolTip for an icon in the* Quick Launch *toolbar can be controlled by changing the name of the corresponding shortcut.*

Dealing with Files Too Large for Notepad

When I double-click a large text file, I get the following message: "This file is too large for Notepad to open. Would you like to use WordPad to read this file?" How do I change my system settings so it prompts me to use Microsoft Word instead of WordPad?

Tom Monaco
via the Internet

You can't change the prompt, but you can change the behaviour with a minor tweak to the Registry. Launch Regedit and navigate to the key `HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\App Paths\WORDPAD.EXE`. In the right-hand pane, double-click the (Default) value to edit its data. Replace the existing data with the full pathname of the program you want Notepad to launch in place of WordPad for text files that are too large.

This change should not affect the *Start* menu link to WordPad, as that link is normally created using the full pathname of the WordPad program. But if you type *wordpad* in the *Start* menu's *Run* dialog box, Windows will launch the program you specified in the `App Paths` Registry key.

Readers occasionally write us with a related question: they want WordPad to take over when Notepad can't handle a large file, but it fails to do so. This problem occurs because the Registry entry for WordPad no longer matches the actual location of WORDPAD.EXE. You can use the same technique described here to restore the normal interaction between Notepad and WordPad.

—Neil J. Rubenking

Configuring DOS-Mode Drivers

I have some programs that I still need to run in DOS mode, and they require that I access my CD-ROM drive and mouse. The problem is that I need to know exactly what to put in my Config.sys and Autoexec.bat files to get this hardware to work when I reboot in DOS mode. Can you help?

Brandon Czarnocki
via the Internet

Unfortunately, there is no way to give a precise answer, because not all CD-ROM drives use the same CD-ROM drivers. The best we can offer is a generic answer that should provide enough detail to get you to the point

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MAIL: PC Tech, *PC Magazine Australia*, PO Box 1287, North Sydney 2059

We regret that we cannot answer letters individually.

where you can work out the specifics on your own. You may need this information even if you don't think you do; the Windows emergency boot disk does not add these drivers, so without making these modifications, you will not be able to access your CD-ROM drive to restore files if you lose your hard disk and have to boot from the floppy.

Under Windows 95 or Windows 98, the operating system can automatically provide virtual-mode drivers for the CD-ROM drive and mouse (and other devices). These will still be accessible when you open a DOS window, but if you reboot in DOS mode, these devices must rely on real-mode drivers, which are loaded in your Config.sys and Autoexec.bat files. You can add the required lines to these files in the Exit to Dos.pif file, or you can add them to a boot floppy.

To Config.sys, you add the line

```
DEVICE=[cdromdriver.sys] /D:[driveid]
```

To Autoexec.bat:

```
[path]MSCDEX /D:[driveid] [path]MOUSE
```

The `[cdromdriver.sys]` parameter in the Config.sys file is the CD-ROM device driver, and you should have received a copy of this with the drive. If you don't have the file, you can contact the drive manufacturer—the company Web site is a good place to start—to see whether there is a copy available that you can download. Failing that, you can try some of the generic drivers available at sites such as *www.windrivers.com/*.

The `[driveid]` parameter in both the CD-ROM device driver and the `MSCDEX` lines must match. Typically, you can use a combination of letters and numbers, and most installations default to ID values like MSCD001. If these ID values do not match, MSCDEX will not find the drive's device driver.

MSCDEX is Microsoft's program CD-ROM Extensions, which provides access to a CD-ROM in DOS. It should be installed in your Windows/Command folder by default. The file also is included on the Windows 95 CD in the Win95_04.cab file and on the Windows 98 CD in the Base5.cab file.

Mscdex.exe also has a number of other parameters that you can use. The one you are most likely to want is the `/L:[driveletter]` switch, which lets you assign a specific drive letter to the CD-ROM drive.

To access the mouse, you'll need another real-mode driver. Again, your system's mouse should have come with an executable program (such as Mouse.com) or a driver with a .sys extension that can be loaded with a `DEVICE=` line in the Config.sys file. If not, you can try using the Mouse.com that was included by Microsoft in Windows 3 and DOS 6 versions, if you should have one of those operating systems available in your archives.

Once you have these lines installed in your boot floppy or Exit to Dos.pif files, be sure to test them carefully, especially if you are modifying your emergency boot disk. Make sure that the files give you access to your CD-ROM drive and mouse now, and don't wait until you need them to find out whether or not the modified boot files work. —*Alfred Poor*

Make sure you can get DOS access to your mouse and CD-ROM drive now; don't wait until you need them to see if they'll work.

When Word 97 Takes a Long Time to Close

Since upgrading to Microsoft Office 97, I've found that Word takes an inordinate amount of time to close—sometimes over a minute with only one document window open. It also takes up to 15 seconds to load the first document after launching, even though later documents load virtually instantaneously. This is particularly annoying since Office 95 ran extremely well on this system, which is a Pentium MMX/233 with 64MB of EDO RAM and a Western Digital 1.6MB hard disk. Is the problem simply that Word 97 is unreasonably slow, or is there something I can do to speed it up?

M. L. Pershern
via the Internet

Sluggish closing of files is probably the most common complaint from Microsoft Word users who upgrade to Office 97. The slowdown comes from a feature that many users—perhaps most—don't even realise exists.

Microsoft Outlook offers a feature called the Journal, which can track several kinds of events on your system. By default, one of the things it keeps track of is everything you work on in Word. Whenever you work on a document, the Journal records the filename, the time you created or opened it, and the length of time you've worked on it. You can view the details as Journal entries in Outlook 97 by choosing *Go | Journal* or by clicking on the Journal icon in the Outlook bar to go to the Journal.

The Journal records these entries whether Outlook is loaded or not, and very likely it records them even if you've never bothered to open Outlook at all. Alas, if you aren't interested in using the Journal, the time it takes to write the entries to disk is simply unwanted overhead.

For reasons that aren't at all clear, the overhead can be virtually unnoticeable on some systems but annoyingly time-consuming on others. Whatever the difference is, it isn't simply a matter of CPU speed and RAM. My test-bed, for example is a 90MHz Pentium with 48MB of RAM. That's severely underpowered compared with the Pentium MMX/233 with 64MB of RAM mentioned in the letter, but closing Word on my test-bed with a file open takes only a second or two—even with the overhead of a Journal entry—compared with the times of over a minute mentioned in the letter.

Fortunately, if the overhead is bothersome on your system, there's an easy way to turn the feature off. Open Outlook and choose *Tools | Options*, then *Journal*. You'll see a number of check boxes for items to track, including one for Microsoft Word. Remove the checks from all of the check boxes and the sluggishness of closing programs should disappear.

Don't be in too much of a hurry to turn off this feature if you don't see noticeable sluggishness on your system. In addition to tracking the amount of time you work on your files, the Journal also creates a shortcut to the document as part of each entry. This can be a lifesaver if you've forgotten where you've saved a file.

To find a misplaced file, you can load Outlook and open the Journal. To see a list of entries if one isn't already showing, choose *View | Current View | Entry List*. To limit the list to Microsoft Word documents, choose *View | Fil-*

ter and then *Journal Entries*, set *Journal Entry Type* to *Microsoft Word*, and choose *OK*. Then click on the *Start* heading at the top of the *Start* column to sort by date and time, and browse though the *Subject* column to find the document you're looking for. Double-click on the document name to open the Journal entry so you can see the shortcut to the file. Double-click on the shortcut, finally, to open it in Word. —*M. David Stone*

Automated Reactions to Cell Changes

In cell A1 of an Excel 97 spreadsheet, I have a remote-reference formula (for a stock market quote) whose value gets updated every few seconds. When the value of A1 changes, I would like to copy the values of cells B2:G2 into A2:F2. At the same time, I'd like to copy the new value of A1 into G2. Is it possible to automate this with a macro?

Rudy Pauls
via the Internet

In a new VBA module, enter the following code:

```
Public Flag as Integer
Sub DoIt()
Range("b2:g2").Cut
Destination:=Range("a2:f2")
    Range("g2").Value =
Range("a1").Value
    Flag = 0
End Sub
```

Then, in the VBA Editor's *Project Explorer* window, double-click the entry for the worksheet you're using—*Sheet1*, for example, if the worksheet where all this action is to take place happens to be Sheet1. You should now see two drop-downs at the top of the code window. One is called *(General)*; the other is called *(Declarations)*. In the first drop-down, choose *Worksheet*. In the second, choose *Change*. Now the following lines appear in the code window:

```
Private Sub Worksheet_Change(ByVal
Target As Excel.Range)
End Sub
```

Between these two lines, type

```
If Flag = 0 And Target.Cells(1, 1) =
Range("a1") Then
    Flag = 1
    DoIt
End If
```

The `Worksheet_Change` procedure triggers the `DoIt` procedure whenever a change occurs in cell A1. The DoIt procedure does the cutting, copying, and pasting. The `Public Flag` variable, shared between the two procedures, ensures that the whole operation occurs only once with each change to A1. Without this, Excel seems to regard the copying of A1 into G2 as a change to A1—and repeats the `DoIt` procedure endlessly. —*Craig Stinson*

Automating Access's Compacting Process

I have a database-compacting program that uses a DOS batch file to make a copy of the database and delete the temporary database (if one exists) and then uses Access code to repair the database and compact it into a temporary database. Another batch file then copies the compacted database using the original database name. It works, but the process is not as smooth as I would like. The problem is that the Access code does not wait for the DOS commands to complete before continuing. This prevents me from automating the whole process.

Dennis Miller
via the Internet

If you're using Microsoft Access 95 or later, you can automate the process using VBA code instead of a batch file. An example appears in Figure 2. Regarding the batch file, however, if you're running Windows 95 or 98 you can use the `start` command with the `/w` switch to execute Access. The `start` command starts the named application, and the `/w` switch tells the command to pause and wait for the application to complete before continuing. Thus you can do something like this:

```
start /w c:\access\msaccess.exe
nwind.mdb /compact tempp.mdb
```

This starts MS Access and automatically invokes the compact process, producing from Nwind.mdb a compacted database named Tempp.mdb. The command does not complete until Access is finished compacting and shuts down. You then have to delete the original database and rename the compacted database with the original name. You should also precede the `start` command with a `copy` command that makes a backup copy of your database, just in case.

You're better off creating a separate database for the purpose of compacting your application database. Once you've created the new database, enter the `CompactMdb` function in Figure 2. The code relies upon the Microsoft Jet database engine's `CompactDatabase` method to compact the database. You pass

```
Function CompactMdb(strMdb As String) As Boolean
   Dim strFileName As String, strCompacted As String, strBackup As String
   On Error GoTo CompactMdbErr
   ' First backup the database.
   strFileName = Left(strMdb, InStr(strMdb, ".mdb") - 1)
   strBackup = strFileName & "Backup.mdb"
   FileCopy strMdb, strBackup          ' Make a backup.
   ' Next compact the database.
   strCompacted = strFileName & "Compacted.mdb"
   DBEngine.CompactDatabase strMdb, strCompacted ' Compact to new file.
   ' Next delete the old and rename the new.
   Kill strMdb                         ' Delete the old uncompacted database.
   Name strCompacted As strMdb         ' Rename compacted database to original
   ' name.
   CompactMdb = True
CompactMdbExit:
   On Error Resume Next
   Exit Function
CompactMdbErr:
   MsgBox "Error number " & Err.Number & ": "
& vbCrLf & Err.Description, , "CompactMdb"
   CompactMdb = False
   Resume CompactMdbExit
End Function
```

You can call the CompactMdb VBA function from your Access application to compact a Jet database.

CompactMdb the name of the database to compact, such as C:\My Documents\Northwind.Mdb, and it goes ahead and does the compacting along with all of the surrounding housekeeping. First it makes a backup copy of the named database. Then it does the compact. Then, if the compact has succeeded, it deletes the original database and renames the compacted database with the original name.

You could call the CompactMdb function from a button on a form, for example, or in event code attached to a form's On Open event. You could add Application.Quit to the end of the event code to force Access to shut down automatically after CompactMdb completes. Finally, you could make the form automatically appear at start-up (see *Tools | Start-up*), after which it would automatically run the code and exit. Thus double-clicking on the database in Windows would automatically cause the form to perform the compact operation and then exit.

As of this writing, Microsoft hopes to let you automatically compact a database upon closing it in Office 2000. In the meantime, however, if coding VBA functions or DOS batch files is not your thing, you can also consider a third-party product called Total Access Agent (*www.fmsinc.com*), from FMS.—*Sal Ricciardi*

Downloading Acrobat Files Direct to Disk in IE

I use Microsoft Internet Explorer as my Web browser. When I click on a hyperlink that leads to an Adobe Acrobat PDF file, Acrobat 3.0 automatically loads and displays the file as it's received. I'd rather download the file to my hard disk and view it later, but I can't figure out how. Is there a way?

Ken Richardson
via the Internet

It's not obvious, but you can indeed download the file directly to your hard disk for later viewing. When you install Acrobat, the Version 3.0 installation program places a small ActiveX control in your Acrobat3\Reader\Activex folder. When you click on a hyperlink that leads to a PDF file, the Acrobat ActiveX control takes over and launches the Acrobat Reader to do the work of displaying and managing the PDF file within an Internet Explorer window. Unfortunately, the reader doesn't offer a menu option for downloading the PDF file to disk.

The trick is to right-click the hyperlink that leads to the PDF file instead of left-clicking to bring up the Reader. A context menu like the one shown in Figure 3 will appear. Next, choose *Save Target As...* and enter a filename in the resulting dialog. Don't forget to give the file a .pdf file extension. Then choose *OK* to close the dialog; the file will be downloaded.

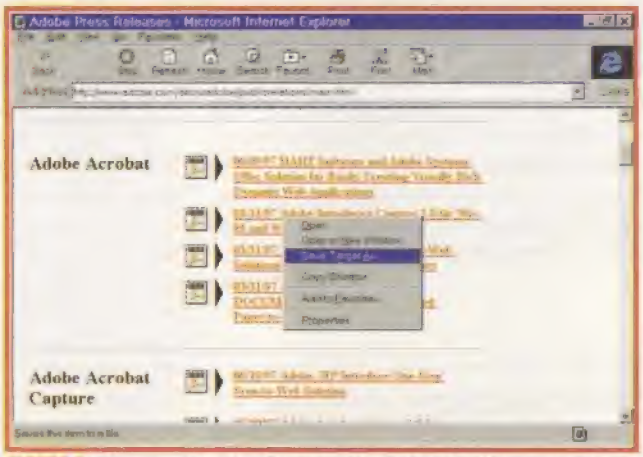

FIGURE 3: *You can download an Acrobat PDF file directly to disk by right-clicking on the hyperlink that leads to the PDF and choosing* Save Target As....

If you always want the choice of either viewing or downloading the PDF file, you can set this up by making some changes to your system configuration. Because this involves editing the Windows 95 registry, I recommend the following only to readers who are experienced in the fine art of registry editing and who have safe backup copies of their registry files. You should probably check with your system administrator, if you have one, before you attempt this procedure.

You can edit the registry using Registry Editor (Regedit.exe), but be sure to make backup copies of the two registry files, User.dat and System.dat, before you begin.

First, open up a Windows Explorer window and look at the files in your Acrobat3\Reader\Activex folder. There will be a file named either Pdf.ocx, Pdf41.ocx, or Pdf42.ocx. Write down the name of the one you have. This is the Acrobat Reader ActiveX control.

Next, select the *Start* menu, choose *Run*, and then type the command that follows, changing the name of the OCX file to the one installed on your system. If you installed the Acrobat Reader in a folder other than the default location, change the command to match your installation. This step unregisters the Acrobat ActiveX control:

```
regsvr32.exe -u
c:\acrobat3\reader\activex\pdf.ocx
```

When you're finished typing, press Enter to run the command. You should see a message that this step has successfully completed.

Next, to run Registry Editor, select the *Start* menu, choose *Run*, enter *Regedit.exe*, and then press Enter. When Registry Editor loads, look for the following key:

```
HKEY_CLASSES_ROOT\MIME\Database\
Content Type\Application/pdf
```

If the key exists, select it, then select the *Edit* menu and choose *Delete*. When you're asked to confirm, choose *Yes*. Next, look for the following key:

```
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\I
nternet Explorer\Plugins\MIME\
Application/pdf
```

If the key exists, select it, then select the *Edit* menu and choose *Delete*. When you're asked to confirm, choose *Yes*. Now select the *Registry* menu and choose *Exit*.

Note that if you have Netscape Navigator or Netscape Communicator installed, you will also have to delete the file Nppdf32.dll, located in Navigator's Program\Plugins folder. This is because Internet Explorer will attempt to load the Navigator plug-in when it doesn't find a registered Acrobat ActiveX control.

That's it. Now when you click on a hyperlink that leads to a PDF file, you'll be asked whether you want to open the file or save it to disk. If you choose *Open*, the Acrobat Reader will take over and you can view the file. If you choose *Save*, you'll be asked to enter a filename and the PDF file will be downloaded to disk.—*Sal Ricciardi*

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Data Warehousing: an Overview

By Gabrielle Gagnon

Data warehousing is the technology trend most often associated with enterprise computing today. The term conjures up images of vast data banks fed from systems all over the globe, with legions of corporate analysts mining them for golden nuggets of information that will make their companies more profitable.

All of the developments in database technology over the past 20 years have culminated in the data warehouse. Entity-relationship modelling, heuristic searches, mass data storage, neural networks, multiprocessing, and natural-language interfaces have all found their niches in the data warehouse. But aside from being a database engineer's dream, what practical benefits does a data warehouse offer the enterprise?

When asked, corporate executives often say that having a data warehouse gives them a competitive advantage, because it gives them a better understanding of their data and a better understanding of their business in relation to their competitors, and it lets them provide better customer service.

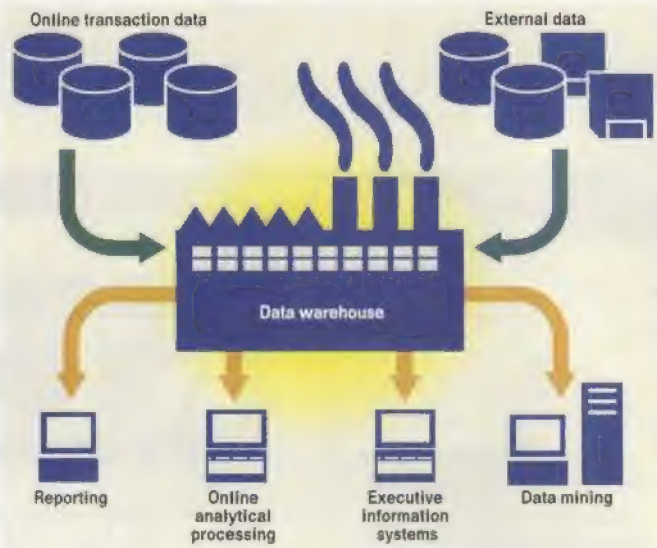
So what exactly is a data warehouse? Should your company have one, and if so, what should it look like?

Essentially, a data warehouse provides historical data for decision-support applications. Such applications include reporting, online analytical processing (olap), executive information systems (eis), and data mining.

According to W.H. Inmon, the man who originally came up with the term, a data warehouse is a centralised, integrated repository of information. Here *integrated* means cleaned up, merged, and redesigned. This may be more or less complicated depending on how many systems feed into a warehouse and how widely they differ in handling similar information.

But most companies already have repositories of information in their production systems, and many of them are centralised. Aren't these data warehouses? Not really.

Data warehouses differ from production databases, or online transaction-processing (OLTP) systems, in their purpose and design. An OLTP system is designed and optimised for data entry and updates, whereas a data warehouse is optimised for data retrieval and reporting, and it is usually a read-only system.



An OLTP system contains data needed for running the day-to-day operations of a business, but a data warehouse contains data used for analysing the business. The data in an OLTP system is current and highly volatile, with data elements that may be incomplete or unknown at the time of entry. A data warehouse contains historical, nonvolatile data that has been adjusted for transaction errors. Finally, since their purposes are so different, OLTP systems and data warehouses use different data-modelling strategies. Redundancy is almost nonexistent in OLTP systems, since redundant data complicates updates. So OLTP systems are highly normalised and are usually based on a relational model. But redundancy is desirable in a data warehouse, since it simplifies user access and enhances performance by minimising the number of tables that have to be joined. Some data warehouses don't use a relational model at all, preferring a multidimensional design instead.

TYPES OF DATA WAREHOUSES

The type of data warehouse an organisation adopts should depend on the way the business operates and the types of decision support it needs.

One of the simplest types of data warehouse, an *operational data store* (ODS) is a replicated production database that has been adjusted for errors. An ODS is used primarily to generate standard operations reports and to provide transaction detail for summary-level analysis. (Since an ODS replicates an oltp system, some experts don't consider it a true data warehouse type. We've included it in our discussion, however, because ODSs fit the broad definition and many data warehouses contain them.)

Depending on an organisation's reporting needs, an ods may be updated monthly, weekly, or more frequently, sometimes almost in real time. Its main advantage is that it enhances production system performance, since reporting and query functions are off-loaded from the oltp system to the ods.

If your organisation just generates operational reports and does little analysis or marketing research, an ods may well suit your needs. On the other hand, if your company handles relatively few transactions per day, an ods may be overkill. You can use the production system to generate reports instead.

Another type of data warehouse is the *data mart*. Data marts are limited in scope, usually taking their information from a single department or business process. They may be used for analysing sales information in a specific region or for a particular product line, for example. Data marts usually contain only summary data, but they can be linked to operational data stores for drilling down to transaction details if necessary. They are sometimes managed by IT departments, but just as often they are managed directly by users in a department or work group.

While many olap applications can be performed on data marts, cross-departmental analysis, executive information systems, and data-mining applications need information gathered from the entire enterprise to be most effective. The *enterprise data warehouse* is used for this type of extensive data collection and analysis. Because of its scope and complexity, the enterprise data warehouse is usually managed by the central IT group.

As its name implies, an enterprise data warehouse contains information taken from throughout an organisation. This is the most complex type of warehouse to build and maintain, since data must be merged from multiple systems into common subject areas.

Different systems often produce incompatible or inconsistent data, and sometimes the data must undergo several transformations before it can be integrated into a data warehouse in a meaningful way. Inmon estimated that 80 percent of the time, building such a data warehouse would be spent on extracting, cleaning, and loading data.

If your organisation can benefit from data mining, building an enterprise data warehouse may be well worth the effort. Data-mining tools work with various statistical techniques for modelling data and for estimating and predicting outcomes based on what they have learned. They work best with large data sets.

There are many ways to build an enterprise data warehouse. One form uses a centralised approach, combining all the enterprise's data in a single, large data store. Another form takes a distributed approach, pulling data from multiple data marts.

DATA WAREHOUSE COMPONENTS

Although a data warehouse sounds like a single entity, it is really a multitiered, multiapplication conglomerate that comprises several components. Each component may be handled by one or more pieces of hardware or software. No vendor has a complete data warehouse package.

Functionally, a data warehouse extracts data from operational systems and loads it into a holding area where it is "scrubbed" (that is, made to conform with warehouse standards), merged, time-stamped or dated in some way, and loaded into databases for use by data access tools.

Since data goes through a number of transformations and is ultimately placed in data structures different from the ones it came from, those changes are mapped in catalogues or dictionaries. Such catalogues are managed with metadata tools. Data that defines or describes data in the warehouse is called *metadata*. There are typically two kinds of metadata. Things that users need to know, such as table and column names and definitions, are called *frontend metadata*. Everything else, such as how a particular data element maps to its original database, is *backend metadata*.

Design and management tools are also important components of a data warehouse. Even though it contains nonvolatile data, a data warehouse is far from static; you can't just build one and forget about it. A data warehouse is a high-maintenance system that expands as the company's demands on it increase. Even if the design of the warehouse itself changes little, the designs of the production systems that feed it are likely to change. These changes must be captured in the data warehouse metadata. Unlike an oltp system, which gives a snapshot of the present, a data warehouse is meant to provide a complete picture of the data over time. This means that whenever any data structure in a production system changes, you have to capture both the change and when it occurred in the warehouse; otherwise queries against historical data may yield peculiar results.

PRACTICAL CONSIDERATIONS

Time and money. In a 1996 study published by IDC, the average cost of building a data warehouse was US$2.2 million, with an average time of 2.3 years to break even. Ninety percent of the companies in the study achieved greater than 40 percent return on investment (ROI), and 50 percent achieved over 160 percent ROI. The average ROI over three years, cumulative, was about 400 percent, with a higher roi for data marts. Clearly, building a data warehouse can be profitable, but it's not a quick hit. Your company should be aware of the amount of investment likely before any payback can be expected.

Space. Data warehouses require lots of disk space. When estimating how much storage space you'll need, don't look at just the current production systems. Remember that you'll be building a system of historical data. Most organisations will want to keep at least a year's worth of data, and if you want to do any kind of trend analysis, you will need several years. Also, reports and analysis usually need more than one index. Be generous in your estimates of disk space. Data warehouses measured in terabytes are not unusual, and some large organisations are even using petabytes. (A petabyte equals 1024 terabytes.)

Consolidation. Combining data from multiple sources may reveal incompatibilities or problems with your OLTP systems. Consistency is especially important for data-mining applications, since most data-mining tools teach themselves how to analyse the data by looking at it. You may need either to do extensive data scrubbing or to fix the OLTP systems. Talk to users about their data needs, and decide whether the result justifies the cost.

Security. Security considerations for data warehouses are different from those for OLTP systems. For a data warehouse to pay for itself, lots of users have to be able to benefit from it, and therefore more users will need access to data than are traditionally authorised by OLTP security. According to experts, a "right to know" mind-set must prevail over the "need to know" philosophy, which would restrict access to data warehouses and minimise their effectiveness. If your organisation can't make that cultural change, a data warehouse may be a wasted investment.

User-friendliness. Data warehouses have to be user-friendly. Since a data warehouse is not a production system, users don't have to use it. And the fastest, most reliable system won't be used if the user doesn't understand it or finds it cumbersome to work with.

Project planning. A data warehouse sometimes takes years to implement. Before embarking on a data-warehousing project, determine what your business objectives for it are, what the potential costs are versus the benefits, what resources you'll need, and how much organisational commitment you'll need. Without good planning and user buy-in, the project is not likely to be successful.

As more and more corporations come to appreciate that the information they gather each day is an asset, they will rely more and more on data warehousing. But while a data warehouse can provide managers with the means to ask questions of their data and get back meaningful answers, it can't automatically make a company more profitable. Whether a data warehouse becomes a valuable strategic tool or an expensive white elephant depends as much on the organisation using it as on the technology. PC

Programming for Windows CE Devices

By Douglas Boling

Windows CE is the "third" Windows. This new operating system isn't nearly as well known as its two larger cousins, Windows 98 and Windows NT, but that's beginning to change. Windows CE is designed for small, battery-powered devices such as personal organisers. While these devices look quite different from desktop and laptop PCs, the techniques used to program Windows CE devices are similar to those used for Windows-based PCs. We'll take a look at how to program Windows CE devices, but first it's important to understand just what Windows CE is, to separate the operating system from the individual platforms that run Windows CE.

Windows CE is a totally new version of Windows. It isn't a modified or stripped-down version of either Windows 98 or Windows NT. Instead, Windows CE was designed from the ground up as a new operating system for battery-powered devices smaller than standard PCs. Users may be more familiar with the Windows CE devices, such as hand-held PCs or Palm-size PCs, than with the operating system itself. These platforms, built by OEMs such as Hewlett Packard and Casio, bundle a version of Windows CE in their ROMs. Because of this, users never install Windows CE; it comes by default on these devices.

Windows CE supports a subset of the ubiquitous Win32 API used in Windows 98 and Windows NT. While the word *subset* might send chills down the spine of a Windows NT developer, rest assured that the differences in the API between the desktop Windows versions and Windows CE don't cause too many challenges. The differences mainly involve elimination of the redundant functions that exist in the Win32 API for backward compatibility with previous versions of Windows. For example, there may be three or four ways to open a file programmatically in the desktop versions of Windows; under Windows CE there is only one, CreateFile.

Other differences in the API occur in areas where Windows CE doesn't implement the entire array of functions that Windows NT does. For example, the Winsock library supported by Windows CE doesn't include most of the WSAAsync functions supported by Windows 98 and NT. There is no loss of functionality in the Windows CE version, you just have to use a more pure Berkeley version of socket programming when using sockets under Windows CE. For Windows programmers, this means you need to learn how to use basic blocking and nonblocking sockets without the helpful WSAAsync functions that, on Windows 9*x* and NT, notify applications when socket events occur.

The other major difference between Windows CE and its larger cousins is that it is designed to be reconfigured by OEMs to better fit specific hardware platforms. For example, the requirements for a hand-held PC professional, which is a mini-notebook that runs Windows CE, are much different than those of a Palm-size PC device. Because of this, Windows CE can be *componentised* to remove parts of the operating system that may not be needed on the target platform. This goes far beyond simply not including a DLL in a specific platform. Windows CE can be configured so that, for example, the cursor API that controls the look of the pointer on the screen, or even the clipboard component, can be removed if it is deemed unnecessary for the specific hardware platform.

This componentisation of Windows CE is done by the OEM for vertical market platforms, or by Microsoft for the horizontal platforms. A particular componentisation mix produces a specific API for that configuration of Windows CE. Thus, the API for a Casio H/PC is identical to the API for an NEC H/PC since both systems use the same configuration of Windows

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CE specified by Microsoft for H/PC devices. On the other hand, there are some subtle differences between the API for an H/PC and a Palm-size PC since the particular components of Windows CE differ between those two platforms. These differences should not be overstated, however. Unless you delve into the specific API functions that aren't supported on one or the other platform, you won't have any trouble writing an application that runs on both. You can always avoid the problem of platform-specific functions by explicitly linking to the functions specific to that platform using `LoadLibrary` and `GetProcAddress`.

In fact, the biggest challenge in writing an application that runs on both platforms is dealing with the different screen sizes used by the two platforms. For example, the landscape screen of the H/PC (640 x 240) requires a different layout for dialog boxes than does a Palm-size PC's portrait screen (240 x 320). A good solution in this case is to create a single dialog box procedure with separate dialog-box templates for the two screen sizes. This way, the proper template can be determined at runtime by the application.

Another challenge of programming Windows CE devices is the perpetually low memory environment in which your application must survive. While Windows CE supports demand paging, it doesn't support a paging file to save read/write data on secondary storage such as a hard disk. In other words, read-only pages, such as application code and an application's read-only data are brought into memory as needed. However, read/write data is never saved in a paging file on a hard disk. This limited demand paging decreases the time it takes to launch Windows CE applications because only the parts of the application that are necessary at start-up are loaded.

But it also means that since Windows CE doesn't support a paging file to save read/write memory, applications are strictly limited to the amount of physical RAM on the device.

Because of this, it's quite possible your application will run out of memory at times. You must therefore write Windows CE applications to use as little RAM as possible and to handle out-of-memory situations gracefully.

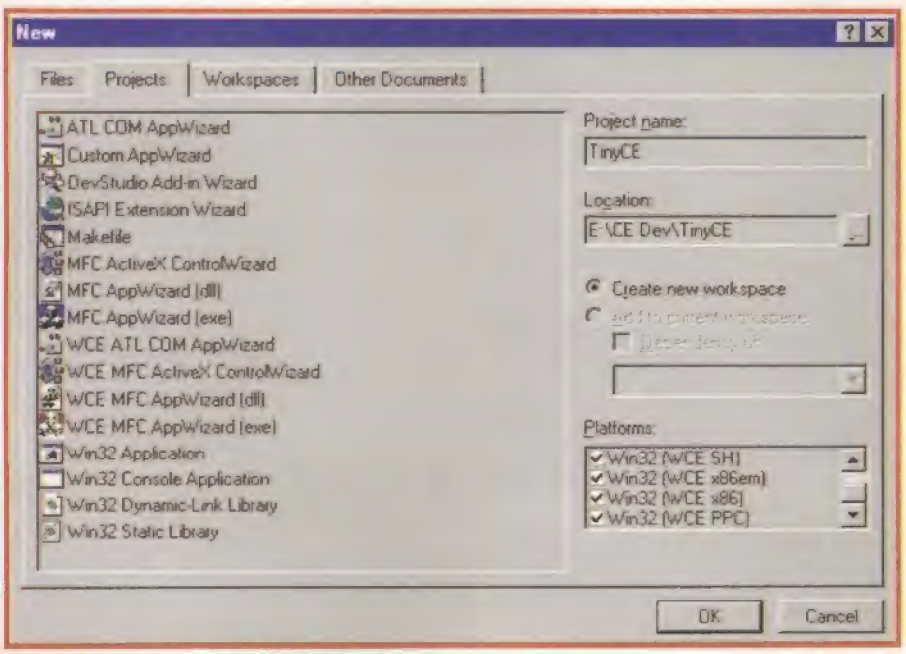

FIGURE 1: *You can create a Windows CE application manually in the VC++ environment by selecting* Win32 application *and checking off the Windows CE target processors you want.*

TOOLKITS

The flexibility of Windows CE presents a challenge to the folks who write programming tools. Since Windows CE supports a variety of CPUs and can be configured in a multitude of ways, each with a different API, how can one development environment be expected to know the target platform? To deal with this, Microsoft has produced an array of development tools for Windows CE, some compatible with all platforms, some supported only on the hand-held PC and hand-held PC professional systems.

The tools are designed to run under Windows NT. Code development is performed in a Developer Studio environment using one of the supported languages indicated below. The code is executed on a Windows CE device attached to the development PC using either a serial link or a network link. The serial link is the standard connection used by Windows CE devices to synchronise data between the device and the PC. Network links provide much faster download speed but, unfortunately, some of the debugging tools don't run when the Windows CE device is attached via a network link.

Microsoft supports versions of Visual C++, Visual Basic, and Visual J++ for one or more of the Windows CE platforms. Visual Basic and Visual J++ for Windows CE are only supported for the hand-held PC and hand-held PC professional systems. At present, to write for the other platforms you must use Visual C++, which is supported across the board. With this in mind, we'll limit our discussion to Visual C++, although there are plenty of reasons you might want to use the other languages on an H/PC or H/PC Pro.

To write a Windows CE application in C or C++ you first install the standard PC version of Visual C++ (either VC++ 5.0 or 6.0) then the add-in product, Visual C++ for Windows CE.

This product, available from Microsoft, provides compilers for all the target CPUs supported by Windows CE and it also includes a version of MFC and ATL supported on H/PCs.

The add-in doesn't prevent you from writing PC-targeted applications, it simply extends the targets so that you can develop for Windows CE.

At this point, you still need the include and lib files necessary to compile a Windows CE application for a particular plat-

form so, if you're writing for a standard horizontal platform, the next step is to install a platform SDK for that specific platform.

These platform SDKs are free from Microsoft and are available on the Microsoft Web site (*http://www.microsoft.com/windowsce/downloads/pccompanions/default.asp*). When you buy Visual C++ for Windows CE, the platform SDK for the H/PC is usually included on the CD, but it's always a good idea to check the Web site to determine if a newer version is available.

If you're porting Windows CE to a new hardware platform, Microsoft offers another tool, the Windows CE Platform Builder, the successor to the Embedded Toolkit that was used with earlier versions of Windows CE. This tool provides the operating system in an object lib format so it can be componentised by the developer for a specific platform.

The Platform Builder also includes the necessary tools for a developer to create a custom platform SDK for the componentised version of the operating system being developed.

Although there's no real need for a software developer who is writing applications for H/PC or other horizontal platforms to use the Platform Builder, it's definitely worth having if you're serious about Windows CE development. This is a complex set of tools, but the information about the architecture of Windows CE you'll gain by working with the Platform Builder is invaluable. We'll talk more about the Platform Builder later.

THE BASIC DEVELOPMENT CYCLE

Now let's turn to writing an actual Windows CE application. The steps you take are the same as those for writing an application for desktop versions of Windows. First, you create a new workspace within Visual C++. Although you can use one of the many wizards designed to assist you in creating Windows CE applications, you can also create one manually by selecting Win32 application, and checking off the Windows CE target processors you want (see Figure 1).

Once the project is created, you simply write the code and create any resources, including menus, icons, and dialog box templates, almost exactly as you would when writing an application for Windows 98 or Windows NT, with the exception of the aforementioned differences in the API. As we noted earlier, the differences aren't major; nevertheless, a few distinctions in the Windows CE programming model should be noted. First, and on the surface most surprising, top-level windows under Windows CE don't support menus. This doesn't mean that Windows CE applications can't have menus, it's just that they are supported through the command bar control.

The command bar control and its more complex cousin, the command bands con-

```
//=====================================================
// TinyCE - A small Windows CE application
//
#include <windows.h>
#include <commctrl.h>                // Command bar includes

LRESULT CALLBACK MainWndProc(HWND, UINT, WPARAM,LPARAM);

TCHAR szAppName[] = TEXT ("TinyCE");
HINSTANCE hInst;

//-----------------------------------
// Program entry point
//
int WINAPI WinMain (HINSTANCE hInstance, HINSTANCE hPrevInstance,
                    LPWSTR lpCmdLine, int nCmdShow) {
 WNDCLASS wc;
 HWND hWnd;
 MSG msg;

 hInst = hInstance;
 // Register App Main Window class
 memset (&wc, 0, sizeof (wc));
 wc.lpfnWndProc = MainWndProc;              // Callback function
 wc.hInstance = hInstance;                  // Owner handle
 wc.hbrBackground = (HBRUSH) GetStockObject(WHITE_BRUSH);
 wc.lpszClassName = szAppName;              // Window class name
 if (RegisterClass(&wc) == 0) return -1;

 // Create main window
 hWnd = CreateWindow (szAppName,            // Window Class
                      szAppName,            // Window Title
                      WS_VISIBLE,           // Style flags
                      CW_USEDEFAULT,        // x position
                      CW_USEDEFAULT,        // y position
                      CW_USEDEFAULT,        // Initial Width
                      CW_USEDEFAULT,        // Initial Height
                      NULL,                 // Parent
                      NULL,                 // Menu, must be null
                      hInstance,            // App instance
                      NULL);                // Ptr to create params
 // Return fail code if window not created
 if (!IsWindow (hWnd)) return -2;
```

This code illustrates how similar Windows CE applications are to ordinary Windows apps.

www.zdnet.com.au

trol, combine menu and toolbar support as well as a place for application-close and help buttons for Windows CE applications. The controls are designed to be fairly straightforward to program. In fact, a simple command bar that provides a menu and an application-close box takes only three lines of code. The command bands control extends the command bar concept by allowing the components of the command bar, the menu, buttons, and other controls to be separated into separate bands that can be arranged by the user. This control is based on the rebar control developed for Internet Explorer 3.

```
// Standard show and update calls
ShowWindow (hWnd, nCmdShow);
UpdateWindow (hWnd);

// Application message loop
while (GetMessage (&msg, NULL, 0, 0)) {
      TranslateMessage(&msg);
      DispatchMessage(&msg);
}
return 0;
}
//------------------------------------
// Main Windows Procedure
//
LRESULT CALLBACK MainWndProc(HWND hWnd, UINT wMsg, WPARAM wParam,
                             LPARAM lParam) {
HWND hwndCB;
    PAINTSTRUCT ps;
    RECT rect;
    HDC hdc;

switch (wMsg) {
case WM_CREATE:
      // Create a minimal command bar that only has an exit button.
      hwndCB = CommandBar_Create (hInst, hWnd, 0x10);
      CommandBar_AddAdornments (hwndCB, 0, 0);
      break;

case WM_PAINT:
    // Adjust the size of the client rectangle to take into
      // account the command bar height.
    GetClientRect (hWnd, &rect);
      rect.top += CommandBar_Height (GetDlgItem (hWnd, 0x10));

    hdc = BeginPaint (hWnd, &ps);
      DrawText (hdc, TEXT ("Hello Windows CE!"), -1, &rect,
              DT_CENTER | DT_VCENTER | DT_SINGLELINE);
    EndPaint (hWnd, &ps);
      break;

case WM_DESTROY:
      break;
}
return DefWindowProc(hWnd, wMsg, wParam, lParam);
}
```

Another difference with Windows CE applications is that icons are assigned on a class basis within an application, not a window-instance basis, meaning that two windows of the same window class will have the same icon. This doesn't really have much of an impact since a window's icon is displayed only in the taskbar button for the window.

Aside from these issues, most of the other differences have more to do with programming conventions than with programming restrictions or implementation differences. For example, while Windows CE top-level windows can have title bars, by convention they don't. Removing the title bar saves space on the small screens used by Windows CE devices. On the desktop versions of Windows, the title bar is used to drag a window around the screen. This function isn't used often on Windows CE systems since by default, top level windows in Windows CE are all full-screen.

This is a good place to mention one of the new features of Windows CE. Starting with Windows CE 2.1, the window manager supports standard, resizable windows. While the operating system always supported windows of any fixed size, now the window manager supports a sizing border around overlapped windows so that they can be resized by the user. You won't see this used on the new H/PC Pro machines very often, however, since the default is for top-level windows to be full screen, even for these large-screen systems.

With these caveats, lets look at a simple Windows CE application. Figure 2 shows source code for the simple TinyCE application that just displays a line of text in its main window. At first glance, Win32 programmers will be hard pressed to notice the subtle differences between this application and a Windows 98 or NT application.

The program has the same window-class registration, window creation, message loop, and window procedure as any other Windows application. The differences in the example reflect differences in the API as discussed above, such as the use of a command bar to provide a close box. Once the code is written, you use the exact same techniques to compile and run it as you would with a desktop application. Compiling does include an extra step to

download the resulting EXE or DLL automatically to the attached Windows CE device. You can then execute the program on the Windows CE device by selecting the same *Program | Run* menu item (or *Ctrl-F5*) as you would to run a Windows NT program under development.

And, yes, you can step through the program using the integrated debugger. The main difference between debugging a Windows CE application and debugging a local Windows NT application is the impact of the speed of the serial link that connects the development PC with the remote Windows CE system. This link makes single-step debugging a slow and painful process. In fact, I tend to use the debugger for only solving the most intractable of bugs.

There are alternatives to using the remote debugger. The platform SDKs for the H/PC, Palm-size PC and Auto PC all include emulator programs that attempt to emulate the remote Windows CE device on Windows NT. This emulator runs a specially compiled version of your application. It emulates the Windows CE API including the extensions such as the database API. The problem with the emulator is that it does not model the Windows CE environment perfectly. There may well be times when, after a day's work, you realise the problem you're chasing is an emulator issue, not a bug in your code.

It's a good idea to create your Windows CE application so it can be compiled for both Windows CE and Windows NT, thus avoiding emulator problems. This approach lets you work on the generic parts of the application locally under Windows NT and, simply by selecting a different target, compile for Windows CE. But if you do this, remember not to stay too long on either platform. If you spend too much time compiling for Windows NT, it may take some work to make the changes for the program to run under Windows CE.

Writing code that will compile for both Windows NT and Windows CE isn't too difficult. For those parts of the code specific to a particular operating system, use compiler defines to have those sections selectively compile for the specific OS. In the code fragment below, the functions for creating a command bar are encapsulated in # conditional compile statements so they will be included only when compiling for Windows CE.

```
  #ifdef _WIN32_WCE   // If compiling
for CE
   HWND hwndCB;
   // Create a command bar.
   hwndCB = CommandBar_Create (hInst,
hWnd, IDC_CMDBAR);
   // Add exit button to command bar.
   CommandBar_AddAdornments (hwndCB,
0, 0);
  #endif //_WIN32_WCE
```

Of course, writing code is only part of application development. You also need a set of tools to debug and test the application. When you install Visual C++ for Windows CE, a set of remote tools is installed to help you with debugging the Windows CE applications. For the most part, these tools mirror the tools used for desktop Windows debugging. There are Windows CE versions of Regedit, for editing the registry on the Windows CE device; Spy, to monitor messages received by Windows CE windows; and ZoomIn, for examining window pixels. You also get a process monitor that lets you see and monitor the status of the processes running on the device. The status information includes the current threads running in each process as well as the DLLs that process has loaded. A final tool is a memory viewer application that lets you browse the contents of the application's heaps. All of these tools run on the attached desktop PC and communicate with remote client software on the Windows CE device.

Windows CE programmers can develop not only applications, but also modifications of the operating system itself.

THE PLATFORM BUILDER

Developing applications for Windows CE is only one opportunity for developing with the operating system. While the desktop versions of Windows can be ported to different PC compatibles, the kits for doing this are closely held by Microsoft and its approved OEMs. Windows CE is different in that the Platform Builder kit, while expensive, is available through retail channels. Thus, Windows CE programmers can not only develop applications, they can develop modifications of the operating system itself.

The Platform Builder kit provides example source code for the OEM abstraction layer (OAL), which is the layer of code written by the OEM to adapt Windows CE to specific hardware. The OAL includes the Hardware Abstraction Layer (HAL) code to support the needs of the Windows CE kernel as well as drivers for built-in hardware such as the keyboard, touch screen and display. Sample source code is also provided for the audio and serial drivers and the PCMCIA controller driver.

The Platform Builder also includes low-level debugging tools. While these tools are primarily designed to assist in porting Windows CE to new hardware platforms, they can also be used when diagnosing intractable problems with application software. Newer versions of Windows CE provide hooks to support a built-in Monte Carlo profiler that can be quite handy for optimising performance in your application. Finally, the Platform Builder includes extensive documentation on the operation of Windows CE from the OEM perspective.

Windows CE is an interesting programming environment. The Win32 API makes it very similar to programming Windows 98 or NT, but the limitations of the hardware intrude on application design. The slower CPUs and limited memory of most Windows CE devices make you think about your programming in a different way, from an efficiency perspective. In fact, it's kind of refreshing to see programmers actually having to worry about CPU speed and code size in these days of multi-megabyte PC applications. PC

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GAMESPOT

We Can Be Heroes

Lead an army of knights across the countryside.

HEROES OF MIGHT AND MAGIC III

Have you ever played a game that's felt a little too simplistic during the first half-hour, only for it to suddenly dump on you, like a tidal wave, in the second half-hour? **Heroes of Might and Magic III** is one of those games that creeps up on you slowly, feeling very easy and intuitive, until suddenly there's an army of skeletons to your North; a group of Medusa's to your south and some Elves about to kick-in your front door. What was that about "easy"?

Heroes of Might and Magic III is a turn-based strategy game, requiring the player to recruit "heroes"; distinctive characters with an individual name, appearance and class (such as Barbarian, Battle Mage, Warlock and Knight to name a few), to explore an overhead map featuring treasure, artifacts, landmarks and, as befits any good fantasy game, monsters.

Through each hero's exploration, resources are gathered which can be used to buy troops for the hero to lead into battle, or to buy buildings which allow the creation of more powerful troop types. Heroes themselves, can gain experience, skills, and spells while exploring, making them reasonably customisable within their respective classes. There's nothing like leading your troops into battle under the guidance of a Level 19 Battle Mage who knows the proverbial every trick in the book.

HEROES OF MIGHT AND MAGIC III
Price: $89.95, Directsoft, 02 9482 3455,
www.3do.com

While the majority of Heroes III is played by moving your hero's icon (the icon represents the hero and any troops marching with him/her) around the overhead map, combat takes place on a completely different screen, best described as a side view. On this screen, your hero and any troops under his/her command, are represented by colourful, animated icons. Each icon has a box next to it, indicating how many troops of its type are on the field. A zombie with "32" next to it, for example actually represents 32 zombies. This can be a little disconcerting at first, as your battles sometimes appear to take place between just a handful of combatants when, in actual fact, there might be 100-200 troops fighting.

Any player interested in managing resources and fantasy characters, a la Warcraft, might be interested to see how much better such a game can be when played in turns, rather than real-time.

As far as scenarios go, Heroes III offers a number of single player games in addition to a campaign which spans six different mini-campaigns—enough to keep most players happy for some time. For those keen to take on their friends, up to eight players can compete in Heroes III via hot-seat (literally playing at the same PC), LAN or over the Internet through Mplayer.com or HEAT.

One of the best (but probably most overlooked), features in Heroes III, is an autosave facility, which saves the game after each turn. This is a real boon for players who don't want to go through the process of manually saving a game every couple of minutes, lest their army is destroyed on the next turn.

For sheer depth of gameplay-without getting lost in minutiae, Heroes III is definitely one of the class acts of 1999. —*Rob Irwin*

CD DOWNLOAD

Tanks for Everything

TANKTICS

Tanktics casts you as the hero of the hour, waging war against the Evil Black Tanks in a bid to free all of tankdom from their despicable clutches. You have been sent back in time, to an age before the Evil Black Tanks had established their grip on the world. Your mission: fight your way through time, destroying the influence of the Evil Black Tanks in every era of history and, ultimately, annihilating their wickedness for ever. Hurrah!

In order to achieve your mission of world liberation, which is after all what Tanktics is all about, you take control of a heavy-duty, anti-gravity crane. The cranes hover above a massive 3D polygonal landscape, which features grassy plains, rocky mountains, lakes, lava, quicksand, forests, snow and ice—just like our world, but brighter! The crane is mouse- or key-controlled and races across the landscape at very fast speeds.

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Each crane has a magnet that lets you manipulate, pick up, assemble and control your forces.

Got Him! Yes! He's Out!

Forget your joysticks, this is cricket management.

AUSTRALIAN CRICKET CAPTAIN

Sports management simulations have never set the Australian software scene alight thanks to the relatively small number of punters who can be bothered managing an overseas team in any given sport. But the genre could be set for an upswing with the release of **Australian Cricket Captain**.

From the outset it must be said that this is a true enthusiast's game. Being a management simulation, the majority of your time is spent pouring-over the statistics of real Australian cricketers from the Mercantile Mutual Cup, Sheffield Shield, One Day International and Test teams. From this data you must attempt to put together the best team to take the field in the face of random events (events such as players being selected for the Australian team and thus ineligible for their state sides, players being injured, falling ill and so on).

Matches aren't so much played, as plotted. Super-keen cricket fans can conduct their games on a ball-by-ball basis, selecting field placements, which bowlers to use, and more, before watching the action played-out by little cricketers on the screen. However, this style of play takes a long time—you literally have to click the mouse for each ball to be bowled-and can grow tedious very quickly. Try playing a Test match and see for yourself!

AUSTRALIAN CRICKET CAPTAIN
Price: $79.95, Metro Games, 03 9329 2999,
www.empire.co.uk

Fortunately, an over-by-over version can be played, which doesn't take as long as the ball-by-ball game, and still allows some control of bowlers and field placings. For those who can't be bothered with watching their little men running around the pitch at all, a third gameplay option is available, which simply gives a match result. Although this option doesn't take any time, it feels strangely unsatisfying to spend up to 10 minutes preparing a team, only for a result (which you have no actual control over) to be generated in about 10 seconds.

Graphically, the game is adequate, with its little animated cricketers running all over the place, simulating the on-field action. Statistic screens are clear and inviting, making it easy to see whether you should be selecting Shane Warne or Stuart McGill as your team's spin bowler. The interface for changing players and their batting order is also relatively easy to learn.

Unfortunately, despite some attention being spent in the graphics department, the game is limited soundwise. Silence greets the statistic screens, with a very ordinary crowd noise in the background of each match. Commentary from former Test captain Ian Chappell is also rather flat, with none of the zest he displays in his TV commentaries. Maybe he just needs another commentator to argue with. Who knows?

To conclude, we must reinforce that Australian Cricket Captain is not a game in the style of EA's Cricket '97. There's no grabbing your joystick and trying to pull-off an extra tricky cover drive when the pressure's on. This is serious stuff. The game might be of particular interest to older players, who want to simulate cricket matches based on their knowledge of the game and its players, as opposed to those who like to exercise their joystick control. —*Rob Irwin*

CD DOWNLOAD

Slaves on S-19

Free the world from a fate worse than death.

SLAVE ZERO

In a bleak future world, the city S-19 is ruled by the evil Big Brotherish SovKhan. In order to secure his absolute rule, SovKhan has created the Slaves, enormous biomechanical beings that keep the populace of S-19 suitably oppressed. Inevitably, the people chafe under this heavy hand, and a rebellion breaks out; you, as a particularly intrepid rebel, take control of a Slave to start the dirty work of freedom fighting, eventually taking the battle directly to the palace of SovKhan himself.

The story behind **Slave Zero** is gripping, but that's not where it ends, the game-world of Slave Zero is easily one of the most vivid gaming environments we've seen. The city absolutely teems with life. It's not uncommon to find yourself on a highway overpass, weathering an attack from multiple Slaves atop flanking buildings, human soldiers, and tanks from the road beneath you, as attack aircraft buzz around your head. Throw in sweeping searchlights and screaming pedestrians running for their lives, and you've got more action in one moment than you'll find in entire levels of other games.

DOWNLOAD FROM THIS MONTH'S COVER CD

Better still, you can interact with all this life beyond merely shooting at it. Running low on missiles? Grab that passing bus and show that enemy Slave what throwing hard heat is all about. Spot a personnel carrier approaching to unload ground troops? Drop one of those pesky enemy tanks on it. Feeling artistic? Make your own Jackson Pollock masterpiece by hurling pedestrians at a wall. This is what being a giant robot is all about.

One Murder, Six Suspects

Take your favourite boardgame to another dimension.

CLUEDO

Cluedo is a classic boardgame that has earned the right to sit on any shelf alongside that other perennial favourite, Monopoly. How fitting, therefore, that **Cluedo** get its own PC makeover in the wake of Monopoly's successful conversion to PC a couple of years ago.

Just like the boardgame, Cluedo involves six characters—Miss Scarlett, Colonel Mustard, Mrs White, Reverend Green, Mrs Peacock and Professor Plum—staying in a mansion when its owner, Doctor Black, is murdered. The characters must move around the mansion, from room to room, trying to unravel which one of the six committed the murder, what implement was used and which room the murder was committed in.

The murderer, weapon and scene of the crime is randomly generated at the start of each game so it could even be your character that has actually committed the murderer!

You solve the mystery by making suggestions regarding the murder. When you make these suggestions, your suspicions are brought to life in an entertaining cut scene. If you are wrong about your assumption, you are disproved by one of your fellow players and you begin to narrow down the possibilities. If no-one can disprove the allegations, you can opt to make a formal accusation, but watch out—if you're wrong, you instantly lose the game.

CLUEDO
Price: $59.95, Dataflow, 02 9417 9700, www.hasbro-interactive.com

Like the Star Wars facelift that was recently given to the PC version of Monopoly, Cluedo is brought to life by a 3D game board view, with fully animated characters walking around. How satisfying to see Miss Scarlett shimmy from room to room while Colonel Mustard walks with military precision. For the more traditional, an overhead view is also available, with characters represented by the more traditional coloured playing pieces of the boardgame. But while the 3D mode looks great (and even lets you perform a few cute little tricks such as opening draws and turning on desk lamps), it is ultimately unplayable. Even if you choose the transparent walls option, it is impossible to determine where the character is located and where he or she should move in the 3D view. Despite obvious benefits of the 3D view, you will find yourself having to switch to the traditional view in order to play properly.

An interesting feature of PC Cluedo is the "no dice" option. Rather than rolling a die and moving that many squares per turn, each player can have nine steps to move each turn, resulting in a faster and slightly fairer game than when depending on a roll of the dice.

Any game worth its salt these days offers some kind of multiplayer version and Cluedo is no different. The multiplayer option is available for play over a LAN or via the Internet Game Zone. But while you also have the option of playing multiplayer on the one machine, we recommend you forget about it. Cluedo involves a great deal of secrecy, so unless you trust your opponent to turn away from the screen every time your secret information is displayed (and vice versa), forget this multiplayer option.

If you're a fan of Cluedo but have no-one to play against, this game will provide you with all the competition you'll ever need, at any skill level. If, however, you already own a copy of the boardgame and play it regularly, the game is relatively non-essential.

—Anna Raciti

Hold On to Your Beenies

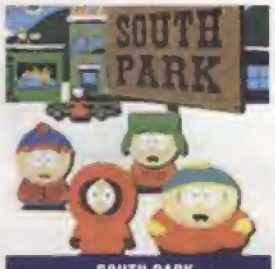
The South Park shooter may leave you wanting.

SOUTH PARK

When Acclaim acquired the license to South Park and announced it would develop a first-person shooter designed by the makers of Turok, we hoped that **South Park** the game might be as good as South Park the show. Yet while the result is an outstanding interpretation of the show's distinctive look, the game comes across quite boring and ill conceived.

The game looks great—the flat paper cutouts of the television show are faithfully reproduced with flat, bright colours and sparse detailing. All the major characters are here, as well as most of the minor ones. You'll even hear new dialogue during the "mission briefings" where Chef explains to the children what they're up against. But don't expect much more than that—the game is held back by uninspired gameplay.

You'll be greeted familiar threats from the big-boned Cartman and plenty of incomprehensible mutterings from the unfortunate Kenny, but when Cartman's guaranteed to cuss whenever he takes a hit, you'll probably turn the volume down.



SOUTH PARK
Price: $89.95, Acclaim, 03 9347 0114, www.acclaim.net

South Park is an incredibly simplistic shooter. Half the enemies run straight for you, and the other half throw something at you once in a while. You face these foes in enormous swarms, and they're really tough to bring down, but they're also really stupid and practically harmless except in swarms. On the positive side, unlike some shooters, in this game, you'll spend almost all your time shooting. But despite the wide variety of funny weapons (from your trusty snowballs to toilet-plunger launchers), you'll quickly get sick of fighting off so many enemies. If the bad guys were smarter and if the levels were more interesting, South Park would have been a better game.

Worms of the Apocalypse

Small and pink, but decidedly unfriendly.

WORMS ARMAGEDDON

If your idea of the perfect PC wargame involves militarily accurate weaponry, artificial intelligence (AI) that would stump Einstein and 3D graphics powered by the latest PIII-500, then it's fair to say that **Worms Armageddon** (WA) probably isn't the right game for you.

From the outset, WA is proof that computer games do not always have to evolve in outlandish and CPU-intensive ways to remain fresh and enjoyable. Indeed, running quite happily on a 100MHz Pentium with 32MB of RAM, WA isn't radically different from its predecessors, **Worms** (1996) and **Worms 2** (1998).

For those unfamiliar with the Worms "formula", one of the best ways to describe the game is to compare it to those old DOS programs, where you were given a cannon and placed on one side of a large hill. On the other side, your computer opponent had a cannon, too. The fun came in finding the right combination of trajectory and power, to send a cannonball over the hill to knock-out your opponent's cannon, before it could hit you.

WA is a 2D, turn-based strategy game where the cannons of the old DOS games are replaced by opposing teams of worms, armed to the teeth—or whatever worms use for teeth—with some of the most diabolical weapons around. Each turn, you are given control of a worm (game options allow you to shuffle through your team in order or select a particular worm each turn), which you can then move around the screen and/or select from a multitude of nasty weapons for the little critter to fire.

WORMS: ARMAGEDDON
Price: $79.95, Hasbro Interactive, 02 9953 8788,
www.team17.com

Firing can be a hit and miss affair, with the right trajectory/power ratio different for just about every weapon. It certainly takes a few games to figure-out how hard a stick of dynamite should be thrown, for example, so it doesn't land just a few centimetres away from your own worm, blowing him (or her) to Kingdom Come! Weapons begin with the mundane, such as baseball bats, battle axes and handguns and extend to some really fun toys in miniguns, napalm strikes and homing missiles. Superkeen WA players will love old women, the holy hand grenade (shades of Monty Python humour, there) and find Indian nuclear tests to be excellent offensive weapons, too.

Battles take place on extremely imaginative, colourful maps, representing scenes such as junkyards, villages, forests and cities. Worms are scattered at random over this terrain, which means you could begin a game with some team members stuck on the wrong side of an obstacle or, even worse, right next to an opponent itching to use a petrol bomb! This can lead to some inspired gaming, as you wonder "How am I going to get out of this one?" while rockets go whizzing around your team's ears.

Finally, it must be mentioned that WA wouldn't be half as fun if it weren't for the truly excellent sound effects and voices that you encounter throughout the game. Making good use of the CD format, WA comes packed with 18 different "sound sets" so you can make your team sound like demented Scotsmen, Shakespearian actors, Rastafarians or whatever takes your fancy. It's extremely funny to hear a Carribean war cry or a British worm yelling, "Oi! Nutter!" in the middle of a battle. Other customisable features include your team name, theme music, flag and the names of your individual worms. Strangely, you can become quite attached to your team after a few games and the sight of your favourite worm being blasted by a rocket can bring quite a lump to the throat. Consider yourself warned!

—Rob Irwin

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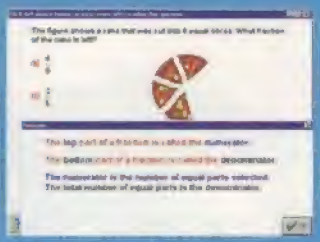

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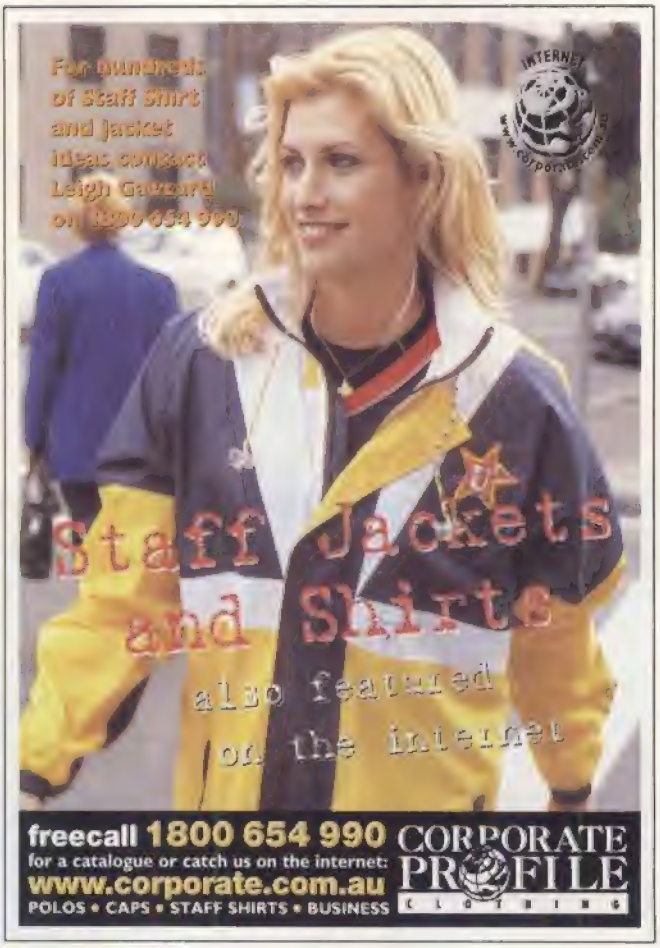

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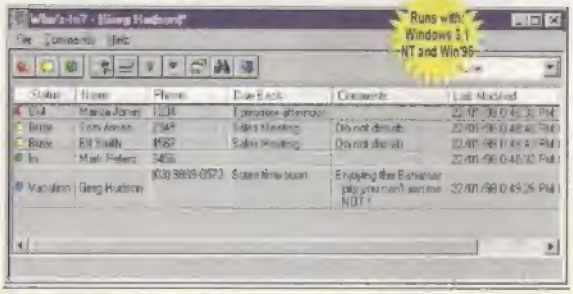

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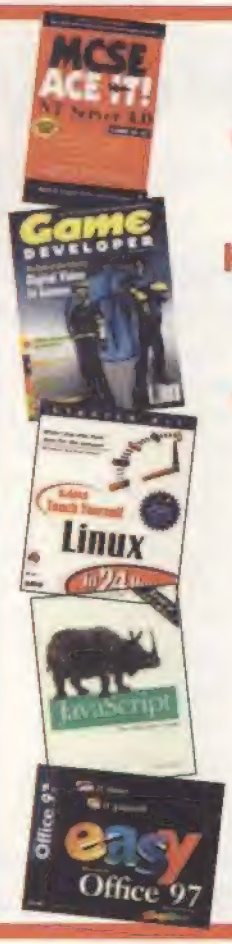

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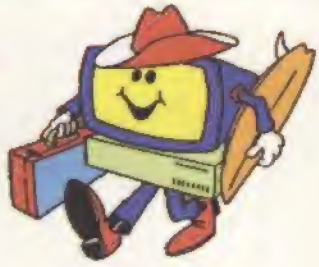

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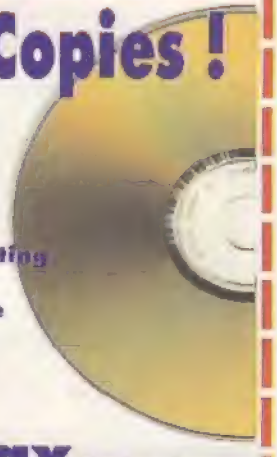

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